

# LOUISIANA COASTAL WETLANDS RESTORATION PLAN



## MERMENTAU BASIN APPENDIX H

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TASK FORCE

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**LOUISIANA COASTAL WETLANDS  
RESTORATION PLAN**

**MERMENTAU BASIN PLAN  
APPENDIX H**

Louisiana Coastal Wetlands Restoration Plan  
Mermentau Basin  
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## INTRODUCTION

### STUDY AREA

The Mermentau Basin lies in the eastern portion of the Chenier Plain in Cameron and Vermilion Parishes (Figure 1). The 734,000-acre basin is bound on the east by Freshwater Bayou Canal, on the south by the Gulf of Mexico, on the west by Louisiana State Highway 27, and on the north by the coastal prairie.

The Grand Chenier and Pecan Island ridge systems are linked by Louisiana Highway 82 and divide the basin into two distinct subbasins along an east-west line. The Lakes Subbasin lies to the north of this line and includes Grand and White Lakes and the Gulf Intracoastal Waterway. The Chenier Subbasin lies to the south of Louisiana Highway 82 and includes Hog Bayou, Rockefeller Refuge, and other marsh and open water areas south of Pecan Island. About 18 percent (128,200 acres) of the basin acreage is publicly owned by the Federal and State governments as refuge and wildlife management area lands.

### EXISTING PROTECTS

#### U.S. ARMY CORPS OF ENGINEERS

The U.S. Army Corps of Engineers (USACE) operates and maintains navigation channels and associated locks and water control structures in the Mermentau Basin which primarily affect the Lakes Subbasin. Their operation facilitates navigation and maintains the lakes as a freshwater source for rice irrigation north of the coastal marshes.

The Gulf Intracoastal Waterway (GIWW) provides a protected inland waterway for shallow-draft traffic. The design channel is 12 feet deep over a 125-foot bottom width. The channel was originally about 200 feet wide at the water surface, but navigation-induced erosion has increased the width to several hundred feet. To prevent saltwater from intruding into the Mermentau Basin, locks were constructed on the waterway and associated navigation channels. These structures, described below, are shown in Figure 1.

The Calcasieu Lock, completed in 1950, controls saltwater intrusion via the Calcasieu Ship Channel into the GIWW. Although outside the western boundary of the Mermentau Basin, this structure provides protection to fresh marshes within the northwest portion of the basin.

The Leland Bowman Lock on the GIWW, completed in 1985, replaced the old Vermilion Lock (constructed in 1933) with a larger structure to accommodate commercial boat traffic. Located on the eastern edge of the basin, the structure controls saltwater intrusion from Vermilion Bay via the GIWW.

The Schooner Bayou Lock was built in 1913 to control saltwater intrusion through the old Inland Waterway, which provided an avenue for saltwater intrusion from Vermilion Bay. The lock was replaced by the Schooner Bayou Control Structure in 1951.

Catfish Point Control Structure, completed in 1951, is located at the Mermentau River's exit from Grand Lake. The structure was installed to prevent saltwater intrusion into the Grand and White Lakes system.



The Freshwater Bayou Canal, completed in 1968, was constructed to provide a navigation channel from Intracoastal City to the Gulf of Mexico. The project also consists of the Freshwater Bayou Lock and jetties. The purpose of the lock is to prevent saltwater intrusion into sensitive interior wetlands. However, since this channel is connected to Vermilion Bay, salt water can reach the interior wetlands from the northern end.

The Mermentau River Gulf of Mexico Navigation Channel, completed by local interests in 1971, is a 4.6-mile-long, 15-foot-deep, and 200-foot-wide waterway that connects the Mermentau River at Grand Chenier to the Gulf of Mexico. The USACE assumed maintenance responsibilities in 1976.

The Mermentau River below Grand Lake has been enlarged to a cross-sectional area of 3,000 square feet to improve the discharge of flood flows.

#### U.S. FISH AND WILDLIFE SERVICE

Lacassine National Wildlife Refuge is a 32,600-acre refuge established in 1937, primarily to provide winter habitat for migratory waterfowl. Cameron Prairie National Wildlife Refuge, established in 1989, is a 9,600-acre refuge that provides winter habitat for migratory waterfowl.

#### U.S. SOIL CONSERVATION SERVICE

The Soil Conservation Service (SCS) has been involved in wetland conservation planning with many landowners in the basin through local conservation districts. The SCS is involved in a river basin study which will lay the foundation for future activities within the basin as far as conservation planning for agricultural and related lands.

#### STATE OF LOUISIANA

##### Department of Natural Resources.

Pecan Island Freshwater Introduction is a state-funded wetland conservation project completed in July 1992. This project consists of a water control structure under Louisiana Highway 82 which diverts water from White Lake through the Pecan Island Canal into the marshes south of the chenier. Existing oil and gas access canals provide a distribution network for the freshwater outfall into the marsh through existing management structures. Introduction of sediment and fresh water through this project will lessen the intrusion of saltwater into this subbasin and reduce marsh loss (State of Louisiana 1990-93).

##### Louisiana Department of Wildlife and Fisheries.

The Rockefeller Refuge is an 86,000-acre state owned refuge established in 1920. An intensive marsh management program was initiated in 1954 in response to prolonged drought and alterations of salinity patterns. The refuge is divided into seventeen management units, with four major management programs in effect on thirteen of the units. These programs are: passive estuarine, controlled estuarine, gravity drainage, and forced drainage. Several water control structures on the refuge are operated to manage water and salinity levels within the Mermentau Basin.

## **INTRODUCTION**

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### **PRIVATE**

Several large landowners in the basin are involved in marsh conservation planning and implementation. These include Vermilion Corporation, Miami Corporation, M.O. Miller Estate, Amoco Corporation, Lake Arthur Hunting Club, Crain Brothers, and the Nature Conservancy. Many of these large landowners have management plans on their wetlands. The Audubon Society maintains a refuge within the basin.

## PROBLEM IDENTIFICATION

### EXISTING CONDITIONS

#### GEOMORPHOLOGY AND HYDROLOGY

Prior to alterations by humans, delta-building processes associated with the Mississippi River resulted in periodic building of marsh along the gulf coast of the Mermentau Basin. Implementation of flood control and navigation projects on the Mississippi and Atchafalaya Rivers interrupted those natural processes.

Consequently, marsh building occurs only on the eastern-most portion of the Mermentau Basin's coastline. This condition is further aggravated by continuing subsidence and sea level rise (the combined effect is known as relative sea level rise). In the Mermentau basin, relative sea level rise results in an average water level rise of 0.25 inches/year.

Unlike basins further to the east, water exchange between basin marshes and the Gulf of Mexico has for a long time been greatly restricted by a beach ridge on the gulf shore. Historically, water exchange occurred only at Rollover Bayou, Freshwater Bayou, and the Mermentau River. Currently exchange is increased due to bayou modification or canal construction for navigation such as Freshwater Bayou modification and Dewitt Canal (Figure 2).

Basin marshes and beaches developed over time in response to pulses of riverine sediments of the Mississippi and Red Rivers. When the Mississippi River changed courses to a more westerly route, large quantities of reworked riverine sediment were deposited along the basin shore and resulted in an outward shift in the shoreline. As the Mississippi River changed to more easterly courses, the shoreline retreated due to reduced sediment supply via littoral transport. These geologic processes of beach building and retreating left a wide zone of coastal marshes and beach ridges in the lower basin. The beach ridges are the cheniers (oak ridges) associated with the Chenier Plain.

#### Lakes Subbasin.

The dominant geographical features of the Lakes Subbasin are Grand and White Lakes. South of those lakes are several cheniers, or natural ridges, including Little Chenier, Little Pecan Island, and East Creole/Chenier Perdue. Coastal prairies north of the coastal wetlands are associated with the Pleistocene Terrace.

Fresh water enters the Lakes Subbasin through the Mermentau River, Lacassine Bayou, the Bell City Drainage Canal, the Gueydan Canal, the Warren Canal, and a number of other drainage canals. Major outlets for discharge of water from the Lakes Subbasin include the Catfish Point Control Structure, the Schooner Bayou Control Structure, and the East End Locks (a gated control structure-not a lock--located on Rockefeller Refuge). A number of small outlets also exist, including the Welfare Bridge, Creole Canal, and Pecan Island Diversion.

A large number of structures have been constructed at sites where salt water could enter subbasin wetlands. The most significant area of saltwater intrusion into subbasin wetlands is in the Little Pecan Bayou area, east of the Mermentau River.

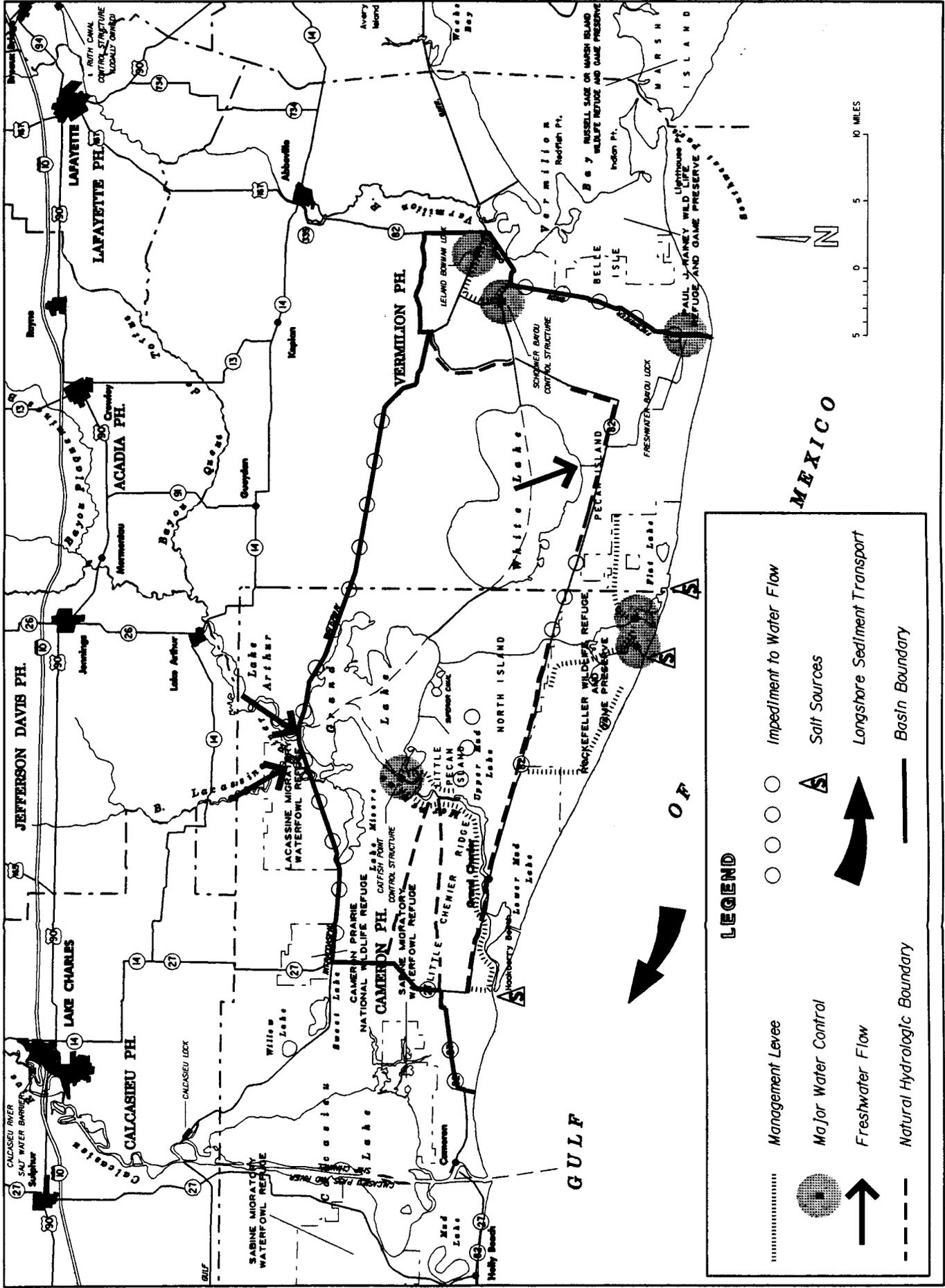


Figure 2. Mermentau Basin, Major Hydrologic Features.

Chenier Subbasin.

The hydrology of the western portion of the subbasin is dominated by the Lower Mermentau River and Lower Mud Lake. The Mermentau River Gulf of Mexico Navigation Channel has altered the hydrology of the river, connecting the river near Grand Chenier with the Gulf of Mexico. Hog Bayou, a tributary of the Lower Mermentau River, connects subbasin marshes between the river and Rockefeller Refuge. South of Hog Bayou, the marshes have experienced minimal alteration and are relatively high in elevation and healthy. North of Hog Bayou, the marshes have been severely altered by forced drainage areas, oil and gas exploration canals, and board roads. Several forced drainage areas have been abandoned, and the majority of these have converted to open water. However, some accretion within formerly deteriorated brackish marshes north of Hog Bayou and near Lower Mud Lake has occurred.

Drainage for Rockefeller Refuge marshes occurs via access canals and small bayous to the gulf. Some water drains westward via a control structure into the Hog Bayou watershed.

The south Pecan Island marshes are located between Rollover Bayou/Canal and Freshwater Bayou Channel. Those marshes have been extensively altered by a series of access canals. Numerous parcels of marsh adjacent to the Pecan Island chenier have been leveed and drained to enhance cattle grazing. Many forced drainage areas in the south Pecan Island marshes have been abandoned and now exist as shallow open water areas.

A small percentage of marshes east of Rollover Bayou/Canal drain via water control structures westward into the bayou. However, the majority of marshes between Rollover Bayou and Freshwater Bayou Channel drain via access canals into the Freshwater Bayou Channel. Dewitt Canal once allowed exchange between the gulf and the canal network within the center of the south Pecan Island marshes; however, it was closed by Hurricane Juan in 1985.

Managed marshes, isolated by canal spoil banks, are maintained primarily as brackish and intermediate marshes through water level and salinity control. A small freshwater diversion structure is currently operating to discharge freshwater from White Lake into a large area of managed marsh south of Pecan Island. This freshwater introduction project has served to partially restore salinity regimes within some of the south Pecan Island marshes.

The Gulf of Mexico beach is retreating across most of the subbasin. However, mud deposits have resulted in a progradation of the shore between Freshwater Bayou Channel and Dewitt Canal. The sediment source responsible for this progradation is likely a combination of reworked Atchafalaya River sediments and reworked spoil from maintenance dredging of the southern end of the Freshwater Bayou Channel. In this area, the shore consists of a very broad mud flat, colonized by smooth cordgrass on slightly elevated ridges.

The subbasin contains abandoned forced drainage areas that have converted to open water. These areas are located adjacent to cheniers where residents would pump off marsh to utilize the area for cattle grazing. Whenever a levee and pump system would fail, the area would be converted to open water due to the shrinkage and compaction of the soils.

**PROBLEM IDENTIFICATION**

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**VEGETATION AND SOILS**

The basin contains about 450,000 acres of wetlands, consisting predominantly of fresh marsh (about 190,000 acres), intermediate marsh (135,000 acres), and brackish marsh (101,000 acres). The marsh soils of the basin are classified into two broad categories, mineral and organic. The organic soils have muck (highly decomposed organics) surface layers 16 to 55 inches thick. The fluid mineral soils generally have muck surface layers that are less than 16 inches thick. Marsh soils are subdivided into three salinity classes: fresh, brackish, and saline. The salinity classes reflect the salinity of the soil surface and not that of the entire soil profile.

Fresh marsh soils generally occur north of the cheniers and account for approximately 58 percent of the basin soils. Brackish marsh, which accounts for 26 percent of the basin’s soils, occurs adjacent to and south of the cheniers. Saline soils occur south of the cheniers near the gulf shoreline and account for 16 percent of the basin soils.

**Lakes Subbasin.**

The distribution of habitat types within the Mermentau Basin is shown in Table 1. Plate 1 provides a visual display of 1988 habitat types in the basin. Wetlands within the subbasin consist primarily of fresh marsh and submergent and floating aquatic vegetation. Areas supporting low-salinity to brackish marsh vegetation include the extreme eastern portion of the subbasin adjacent to Freshwater Bayou Channel, marshes south of Little Chenier, marshes within the Little Pecan Bayou watershed, and marshes within the southern portion of the Superior Canal oil and gas field.

Table 1. Habitat Distribution in Mermentau Basin.

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Wetland Type	Acres
Fresh Marsh	188,665
Intermediate Marsh	135,184
Brackish Marsh	100,684
Saline Marsh	<u>25,246</u>
Total Marsh	449,779
Swamp	48
Other Lands	45,117
Open Water and Canals	<u>225,034</u>
Total Area	734,090

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USFWS GIS Data Base (1988 Habitat Distribution)

### Chenier Subbasin.

Vegetation types within the subbasin range from fresh to saline. Because the subbasin has experienced substantial saltwater intrusion, fresh and intermediate marshes exist only in managed areas.

### FISH AND WILDLIFE RESOURCES

The Chenier Plain basins differ in their fish and wildlife resources from Deltaic Plain basins in the quantity and species of migratory birds that visit these areas: more geese and whistling ducks concentrate in the Mermentau and Calcasieu/Sabine Basins during the year. These basins also receive species that traditionally are restricted to western states. This improves species diversity of birds that visit or reside in the Chenier Plain basins.

### Lakes Subbasin.

The large amount of fresh and intermediate wetlands within the subbasin generally provides high quality habitat for commercially and recreationally important freshwater fishes, the American alligator, furbearers, white-tailed deer, wading birds, resident and migratory waterfowl, and several species of raptors. Because of turbid waters, fish and wildlife habitat quality is reduced in Grand and White Lakes. Those areas do nevertheless support an extensive commercial catfish industry and occasionally produce crops of white shrimp and blue crab. Portions of the Mermentau River south of the Catfish Point Control Structure and the entire Little Pecan watershed serve as nursery habitat for species such as shrimp, blue crab, and seatrout. At certain times of the year, small amounts of salt water may be allowed to enter the subbasin wetlands through the Catfish Point Control Structure and other structures to provide recruitment opportunities for white shrimp. Saltwater intrusion is closely monitored at structure locations to avoid negative impacts to vegetation.

### Chenier Subbasin

The predominance of brackish marsh within this subbasin provides excellent to fair habitat for waterfowl and wildlife. The value of managed areas to estuarine-dependent fisheries is generally low, but this depends to some extent on structure operations. In brackish marshes, structures are often operated to provide for ingress and egress of estuarine-dependent species. Such areas may provide good habitat quality for the American alligator, furbearers, white-tailed deer, resident and migratory waterfowl, herons, egrets, and ibises. Depending upon the degree of deterioration, unmanaged marshes provide excellent to fair nursery habitat for estuarine-dependent fisheries.

Several marsh areas in the basin provide wintering habitat for waterfowl. The Amoco Marsh, a 98,000-acre area, has wintering habitat for 250,000 waterfowl. It is a migration staging area for the fulvous whistling duck, and a breeding and wintering area for the resident mottled duck.

The Pecan Island Marsh, a 98,800-acre area, has wintering habitat for 107,000 waterfowl. The Big Burn, a 59,280-acre area, provides wintering habitat for 130,000 waterfowl annually, and fall concentrations of blue-winged teal exceed 20,000.

## PROBLEM IDENTIFICATION

The basin is part of the North American Waterfowl Management Plan, the goal of which is to protect mallard and pintail migration and wintering habitat.

### ECONOMIC RESOURCES

The cheniers and coastal prairies are the areas where human inhabitation and development predominate. The cheniers are primarily used for residential, commercial, and industrial development and for cattle grazing. The coastal prairies are used primarily for rice, cattle, and crawfish aquaculture. Located within the Chenier subbasin are several large oil and gas fields.

Vegetated wetlands are an important part of the economic base for inhabitants of the Mermentau Basin. Landowners derive income from commercial fishing, trapping, and hunting leases. Job opportunities are associated with hunting leases, and income derived from the sale of fish and hides provides additional economic stimulus for the area. Recreational use of the basins wetlands by sport fishermen, campers, and wildlife observers, also supports the local economy.

### COASTAL WETLANDS PROBLEMS

A total of 104,380 acres of marsh have converted to open water since 1932, which accounts for 19 percent of the historical wetlands in the basin (Dunbar, Britsch, and Kemp, 1992) (Table 2). Forty-nine percent of the land loss occurred between 1955 and 1974. Figure 3 shows wetlands loss associated with different time periods.

Two major highways cross the basin, altering the hydrology of the area. Louisiana Highway 27 forms a hydrologic boundary between the Cameron-Creole Wetlands and the Big Burn Marsh to the east. Louisiana Highway 82 forms a north-south hydrologic boundary between the Lakes and Chenier subbasins from Oak Grove to Pecan Island, and an east-west hydrologic boundary between White Lake and Freshwater Bayou from Pecan Island northward. The highways reduce sheet flow, starve the downstream chenier marshes of fresh water, and increase flooding in the Lakes Subbasin.

Table 2. Historic Wetland Losses in the Mermentau Basin

Period	Lakes Subbasin		Chenier Subbasin	
	(Acres/Yr)	(Percent/Yr)	(Acres/Yr)	(Percent /Yr)
1932-1955	<b>222</b>	0.06	708	0.43
1955-1974	1,457	0.37	1243	0.83
1974-1983	1,439	0.40	622	0.49
1983-1990	1,024	0.29	851	0.71

**USACE GIS Data Base (February 1993).**

### LAKES SUBBASIN

The most critical wetland problem is the subbasin's excessive flooding, which is difficult to solve through gravity drainage due to high water levels in the gulf compared to those in the Lakes Subbasin. A five mile section of Louisiana Highway 27 almost totally blocks drainage of excess water from the western portion of the

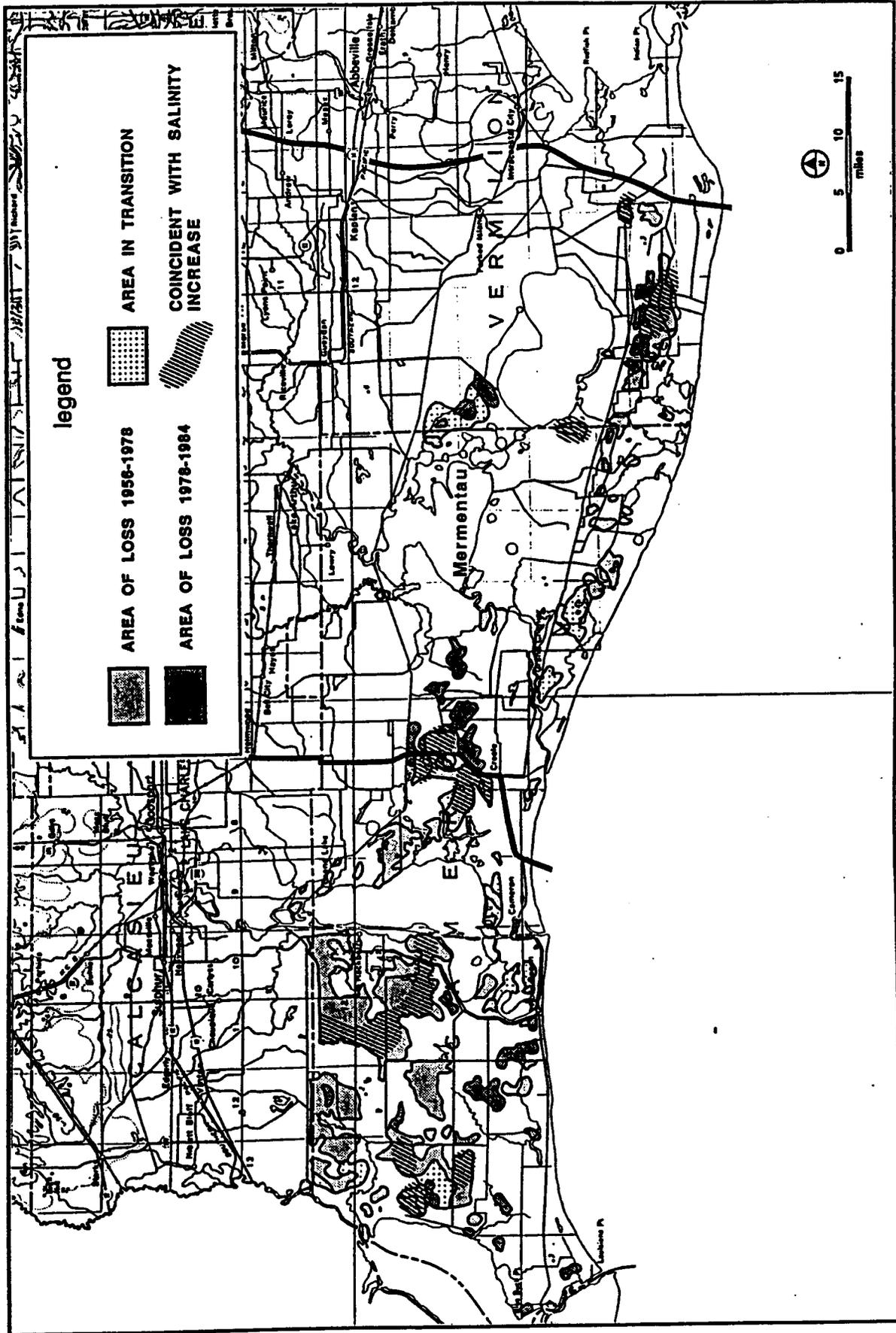


Figure 3. Wetland loss in the Mermentau Basin

## PROBLEM IDENTIFICATION

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Lakes Subbasin into adjacent wetlands of the Calcasieu/Sabine Basin. Similarly, along the southern boundary of the Lakes Subbasin, between Grand Chenier and Pecan Island, Louisiana Highway 82 blocks drainage across a 10 mile section of marsh. On Pecan Island, that same highway blocks a number of small outlets that serve to drain excess water from the Lakes Subbasin into the Chenier Subbasin. On the east side of the Lakes Subbasin, a 7-mile segment of **Louisiana- Highway 82**, south of the original GIWW, has severely reduced drainage across marshes into Vermilion Bay and adjacent wetlands. The eastern drainage routes are further reduced by the construction of the Freshwater Bayou Channel.

While highways have blocked or reduced drainage via numerous relatively small natural outlets, drainage through major outlets is controlled with structures, as at Catfish Point (on the Mermentau River) and Schooner Bayou, which are part of the USACE Mermentau River Project. Furthermore, development and channelization of the Mermentau River watershed has increased the rate of runoff into the Lakes Subbasin. The problem is exacerbated by the basin hydrology. USACE records indicate that water levels within the subbasin exceeded gulf levels only 26 percent of the time for the period from 1987 to 1990. This small window of opportunity makes drainage from the subbasin very difficult. The drainage problem is expected to worsen, given that drainage improvements are continuing throughout the upper portion of the Mermentau River watershed.

Wetlands within the Lakes Subbasin are adversely affected by prolonged periods of high water. Prolonged high water leads to direct wetland loss and shifts in plant species composition. Influx of suspended sediment to the subbasin is very small; marshes must overcome the effects of subsidence and sea level rise (maintain their elevation) primarily through production and accumulation of organic material. Consequently, reduced plant productivity will cause increased marsh loss.

High water levels increase erosion rates along the shores of Grand and White Lakes. High water levels are hastening the erosion of natural lake rims that protect more fragile interior marshes. Once the lake rims are lost, erosion rates accelerate. Erosion from vessel wakes is also a problem along the GIWW and the Freshwater Bayou Channel.

Many areas within the subbasin that have experienced the greatest amount of marsh loss were adversely affected by saltwater intrusion. Saltwater intrusion has mainly impacted marshes adjacent to man-made channels and dredged waterways. In these areas, vegetation in the existing community is not capable of adapting to sudden increases in salinity. Salt-intolerant plant species are destroyed, leaving marsh soils unprotected by plant roots. Under these conditions, organic soils are easily eroded by tidal movement, resulting in a conversion of vegetated marsh to open water.

Marshes adjacent to the Freshwater Bayou Channel are experiencing saltwater intrusion impacts. Throughout most of the area adjacent to the Freshwater Bayou Channel, canal spoil banks provide some protection against saltwater impacts on adjacent coastal wetlands. However, rapid erosion affects several spoil bank locations along the Freshwater Bayou Channel, threatening adjacent fresh and low-salinity marshes.

Deepening the lower Mermentau River south of the Catfish Point Control Structure and the construction of the Mermentau River Gulf of Mexico Navigation

Channel caused saltwater intrusion and marsh loss in marshes south of Grand Lake. The navigation channel bypassed the natural river mouth and its shallow river mouth bars, and saltwater intrusion affects marshes up the Mermentau River to the Catfish Point Control Structure. Where salt water enters fresh marsh areas, severe marsh loss occurs. Marshes within the Little Pecan Bayou area are slightly affected.

Salt water from the Calcasieu-Sabine Basin entered marshes in the western extreme of the Lakes Subbasin via the Welfare Bridge at Louisiana Highway 27. Several thousand acres of marsh were lost in this area. The Welfare Bridge water control structures were installed to prevent further damage at this location. During droughts, saltwater intrusion adversely impacts marshes adjacent to the Superior Canal, south of Grand Lake. The East End structure located on Rockefeller Refuge helps prevent saltwater intrusion into Grand Lake via the Superior Canal.

### CHENIER SUBBASIN

Natural freshwater inputs from the Lakes Subbasin into marshes of the Chenier Subbasin are virtually eliminated by the construction of highway embankments along the southern and eastern boundaries of the Lakes Subbasin. The lack of fresh water is compounded by dredging projects that create additional connections between the gulf and subbasin marshes, facilitating saltwater intrusion.

In the western portion of the subbasin, the natural salinity regime was altered by the construction of the Mermentau River Gulf of Mexico Navigation Channel. Water exchange and salinities in the lower Mermentau River and the Hog Bayou watershed have increased. The combination of regional and localized hydrologic alterations associated with numerous access canals and board roads, plus the failure and abandonment of former forced drainage areas, resulted in extensive marsh loss. Many areas now consist primarily of open water with remnants of functional marsh. Although input of suspended sediments is currently rebuilding deteriorated marshes in the westernmost portion of the Hog Bayou watershed, marshes within the highly altered middle and upper portions of the watershed are continuing to experience substantial losses.

South of Pecan Island, marshes are also severely impacted by numerous access canals. Marshes immediately south of Pecan Island were converted to forced drainage areas, the majority of which are abandoned and now consist primarily of open water. Stresses associated with these hydrologic alterations have been greatly increased by the construction of the Freshwater Bayou Channel and its connecting channel network. Prior to these alterations, marshes south of Pecan Island were isolated from extensive tidal influence. Since the interior marshes south of Pecan Island supported fresh and low-salinity vegetation and were underlain by organic soils, saltwater intrusion and increased tidal exchange associated with the construction of man-made canals caused very extensive marsh loss. Dewitt Canal once allowed tidal exchange between the system of access canals and the gulf, and contributed to saltwater intrusion and excessive tidal exchange.

The hydrology of marshes on Rockefeller Refuge was adversely affected by dredging of numerous access canals. In response to rapid marsh deterioration, a number of marsh management projects were implemented to reduce marsh loss. Many landowners have found active management projects to be successful in

## PROBLEM IDENTIFICATION

achieving this objective. These projects have been used as models for management projects within this basin as well as other hydrologic basins throughout the state.

Westward of the Dewitt Canal, erosion of the Gulf of Mexico shoreline is causing loss of back-beach marshes. Erosion in this area may reach as much as 100 feet per year. East of Dewitt Canal the beach has been accreting due to accumulation of Atchafalaya River sediments. Continued expansion of the Atchafalaya River delta may increase the rate of sediment deposition along the eastern beach and the area beneficially affected. However, without an increase in the rate of flow diverted from the Mississippi River to the Atchafalaya River it is unlikely that historic processes that built and maintained the shorelines will reoccur along the western portion of the basin.

## FUTURE WITHOUT-PROTECT CONDITIONS

### WETLAND CHANGES

Table 3 shows projected wetland loss for 20- and 50-year periods. Wetland loss projected at the 1974-1990 annual rate of 1,980 acres per year for 20 years shows that the basin will lose 39,600 acres. In 50 years, 99,000 acres of wetlands will be lost. Eighteen percent, or 62,900 acres, of the present wetlands in the Lakes Subbasin are expected to be lost over the next 50 years. This loss will occur in wetlands adjacent to the shorelines of White and Grand Lakes and the banks of the GIWW and Freshwater Bayou Canal. Interior losses will continue in the Deep Lake area, Freshwater Bayou wetlands, and the Little Pecan Bayou area.

Table 3. Projected Marsh Loss in the Mermentau Basin.

Subbasin	Projected Loss at 20 Years		Projected Loss at 50 Years	
	(Acres)	(Percent)	(Acres)	(Percent)
Lakes	25,160	7.3	62,900	18.3
Chenier	<u>14,440</u>	12.6	<u>36,100</u>	31.5
Total	39,600	8.6	99,000	21.4

Chenier Subbasin wetland losses are projected to be 32 percent, or 36,100 aaes, over the next 50 years. Interior wetland losses will continue to occur south of Pecan Island and Grand Chenier. Erosion along the gulf shoreline will continue at present rates of 20-40 feet per year.

### FISH AND WILDLIFE RESOURCES

The basin is losing nesting, roosting, and feeding habitat for many migratory species. The loss of vegetated emergent marsh and submerged aquatics affects the quantity and quality of available habitat. This includes loss of wooded spoil banks which could impact resting and refueling areas of value for many migratory birds (Olsen and Noble 1976).

Continued flooding in the Lakes Subbasin will cause wetland loss, a decline in plant productivity, and a shift to plant communities that are less valuable to wildlife. The effects of subsidence and sea level rise will become more apparent as

production and accumulation of organic material decline, thereby increasing flooding.

Deterioration of wetlands in the Chenier Subbasin will continue due to changes in the natural salinity regime and a decrease in freshwater inputs. The abandonment of former forced drainage areas will result in large areas of open, shallow water. Production of estuarine-dependent organisms will decrease in proportion to the loss wetland acreage.

#### ECONOMIC RESOURCES

A reduction in biological productivity due to wetland losses will severely impact the economy of the Mermentau Basin. Revenues from commercial and recreational use of the basin's fishery and wildlife resources will decline as wetlands are lost. The infrastructure within the Chenier Subbasin could be lost or have increased cost of maintenance as the shoreline erodes over the next 20- to 50-year period.

**PROBLEM IDENTIFICATION**

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## PLAN FORMULATION

### PLANNING OBJECTIVES FOR THE BASIN

Insufficient sediment is available to build new mineral wetlands; therefore, the focus in the Mermentau Basin must be on preservation and restoration rather than on creation of wetlands. The basin plan needs to address two key objectives: 1) preserve marshes in the Lakes Subbasin by reducing inundation and erosion; and 2) preserve marshes in the Chenier Subbasin by reducing saltwater intrusion. The third objective is to preserve the geologic framework of the basin by protecting the GIWW banks and the lake and gulf shorelines.

### STRATEGIES CONSIDERED

These objectives lead to strategies that will achieve the stated objectives. The key strategies (Figure 4) include: 1) reduce inundation in the Lakes Subbasin by managing water levels with existing structures; 2) reduce inundation in the Lakes Subbasin by developing additional outlets to the lakes; and 3) reduce saltwater intrusion in the Chenier Subbasin by using water evacuated from the Lakes Subbasin. Additional strategies are: 4) utilize small scale measures to preserve or restore marsh in areas of critical need or opportunity; and 5) preserve the geologic framework of the basin by shoreline and bank protection.

Strategy 1 involves the restoration of inundated marshes by lowering water levels in the Lakes Subbasin through operation modification of existing structures and lock systems. Decreasing water levels to the point that the marsh substrate could be at or slightly below the water surface would allow for growth and development of emergent marsh species. The strategy would be of significant benefit in restoring the basin's emergent marsh vegetative community and increasing habitat for wildlife and fisheries; however, the hydrology of the basin may make implementation difficult or impossible.

Strategy 2 involves the restoration of the basin marshes that are in a flooded condition by creating additional outlets to evacuate water from the Lakes Subbasin. The outcome and importance are the same as in Strategy 1. Strategies 1 and 2 work together to increase the potential cross-sectional area for gravity drainage out of the subbasin.

Strategy 3 uses the creation of additional outlets (Strategy 2) to bring water from the Lakes Subbasin into the marshes of the Chenier Subbasin. The fresh water added to the Chenier Subbasin would provide a freshwater head to push salinities to lower parts of the subbasin. Strategies 2 and 3 provide synergistic effects by increasing the areas available for emergent marsh development in the Lakes Subbasin and reducing saltwater intrusion in the Chenier Subbasin.

Strategy 4 uses small-scale techniques in order to protect or create marsh over areas that may not be influenced by Strategies 1,2, or 3, or areas that are considered hotspots. These techniques provide for protection (through the use of hydrologic restoration, marsh management, sediment and nutrient trapping, and vegetative plantings) and creation (through the use of terracing, dedicated or beneficial use of dredge material, sediment and nutrient trapping, and vegetative plantings). Sediment and nutrient trapping, and vegetative planting projects provide for protection of marshes behind their location while capturing suspended sediment for marsh creation.



Strategy 5 uses both hard and soft structures to maintain shorelines, canal banks and levees, and lake rims. Protection of banks and shorelines is important in providing a barrier between fragile marsh areas and saltwater intrusion or reducing the energy of waves that scour marsh surfaces. Hard structures are utilized in areas that have waves with high energy such as canals with large boat activity or storm generated surges along the gulf shoreline. Soft structures are utilized in areas where the erosive forces of waves are not strong enough to move- the materials used, such as vegetative plantings.

**RATIONALE FOR SELECTED PLAN**

Effective restoration and maintenance of wetlands in the Mermentau Basin requires utilization of all five of the strategies outlined above. Strategies 1 and 2 address the greatest wetlands problem in the Lakes Subbasin-consistently high water levels. Modifying the operation of the existing structures offers only a small (if any) potential for discharging additional water from the subbasin, since discharges are largely controlled by gulf tides. Additional outlets would be required to effect a substantial decrease in the duration of floods.

The primary objective of the Chenier Subbasin is the introduction of additional fresh water. Strategy 3 can be incorporated with strategy 2 to furnish more fresh water to the subbasin, thus reducing saltwater intrusion in the marshes south of Highway 82.

Strategies 4 and 5 can be used to address hot spots in the basin, particularly critical areas of wetland loss occurring along channel banks and lake and gulf shorelines. These measures would utilize shoreline and bank protection measures, terracing, dedicated and beneficial use of dredged material, and restoration of abandoned forced drainage areas to address the cumulative effects of erosion, small-scale saltwater intrusion problems, and other hydrologic alterations.

An additional strategy is possible in this sediment-starved basin. If dredging technology becomes more cost effective, the possibility of pumping gulf sediments into shallow open water or deteriorating marsh in the Chenier Subbasin will need to be studied. This strategy can only be done during the spring floods when the gulf salinities are the lowest in order to avoid placing sediments with higher salinities into marsh environments.



## IMPLEMENTATION OF SELECTED PLAN

### COMPONENT PROTECTS

Projects listed as part of the selected plan have been recommended by the public and participating agencies based on current knowledge of existing conditions, within time constraints of the planning process. Additional projects can be recommended in the future for incorporation in the Mermentau Basin Plan as problems and needs change (see the Implementation section of the Main Report).

The selected alternative consists of 51 projects as summarized in Table 4. The majority of these projects are conceptual. Described below are the projects that make up the basin plan, classified by category and project type. See Figure 5 for locations of critical and supporting projects.

### DEVELOPMENT OF BENEFITS AND COSTS

The benefits for most of the following projects were estimated according to a modified rapid-assessment Wetland Value Assessment (WVA) protocol based in part on project-specific information which varied in quality and quantity among projects. The estimates are therefore rough approximations considered preliminary to a more in-depth assessment, and should be interpreted and used as such. Information for shoreline erosion and marsh creation projects may be more accurate since it is quite site specific. Benefits for hydrologic restoration and marsh management projects require more information than used in the rapid assessment and are thus less accurate.

Projects which have been included on the first three Priority Project Lists have had complete, in-depth WVA analysis.

Cost estimates for all projects were done according to a generic Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) cost formula which includes the construction cost plus construction cost multipliers of 12.5 percent for engineering, and design; 11.5 percent for supervision and administration; and 25 percent for contingencies; plus monitoring and operation/maintenance for 20 years.

Projects on the first three Priority Lists received more rigorous and detailed cost estimates.

### PRIORITY LIST PROJECTS

Four CWPPRA projects in the Mermentau Basin are on the first 3 Priority Project Lists. These include ME-9 Cameron Prairie Refuge in Cameron Parish, ME-8 Vegetative Plantings in Vermilion Parish, ME-4 Freshwater Bayou Wetlands in Vermilion Parish, and ME-5 White Lake Shoreline Protection Demonstration in Vermilion Parish. These projects will preserve or restore a total of 2,166 acres. A detailed description of these projects is found in the Project Description Section below.

Table 4. Summary of the Mermentau Basin Projects

Project No.	Project Name	Project Type	Priority List Projects	Acres Created, Protected, or Restored	Net Benefited Acres	Estimated Cost (\$)	Cost Per Benefited Acre (\$/Ac)	Comments
<u>Critical Projects, Short-Term: Lakes Subbasin</u>								
CS-16	Black Bayou Bypass	FD		115	1,661	4,600,000	2,800	Interacts w/ PME-7, in C/S Basin
XME-19	Old Vermillion Lock	FD		na	na	na	na	Interacts w/ PME-7
XME-20	Schooner Bayou Bypass	FD		na	na	na	na	Interacts w/ PME-7
XME-23	Freshwater Bayou Structure	FD		na	na	na	na	Interacts w/ PME-7
Subtotal: Critical Projects, Short-Term, Lakes Subbasin				120	1,660	4,600,000		
<u>Critical Projects, Short-Term: Chenier Subbasin</u>								
PME-04	White Lake Diversion	FD		126	1,133	2,000,000	1,800	Interacts w/ PME-7 & ME-1
PME-07	Grand/White Lake Diversion	FD		na	na	na		
XME-42	Hog Bayou F.W. Introduction	FD		1,274	2,264	2,000,000	900	
Subtotal: Critical Projects, Short-Term, Chenier Subbasin				1,400	3,400	4,000,000		
<u>Supporting Projects, Short-Term: Lakes Subbasin</u>								
ME-02	Hog Bayou Wetland	MM		20	55	6,419,000	116,700	
ME-04	Freshwater Bayou	SP	PPL2	1,593	4,513	2,032,000	500	Interacts w/ XME-29 & XME-30
ME-05	White Lake Shore Protection	SP		39	143	3,237,000	22,600	
ME-5								
/XME-38	White Lake Shore Protection	SP		975	1,279	5,038,000	3,900	
ME-06	Big Burn Marsh Creation	MC		24	223	647,000	2,900	
ME-07	Deep Lake Marsh Protection	MC		127	526	1,187,000	2,300	
ME-09	Cameron Prairie Refuge	SP	PPL1	247	460	1,109,000	2,400	
PME-01	GIWW Bank Protection	SP		178	178	3,160,000	17,800	Interacts w/ XME-44
PME-03	Old GIWW Shore Protection	SP		20	20	750,000	37,500	
PME-05	Grand Lake South Shore	SP		74	86	980,000	11,400	
PME-14	Sawmill Canal	HR		229	486	1,100,000	2,300	

Table 4. Summary of the Mermentau Basin Projects (Continued)

Project No.	Project Name	Project Type	Priority Acres Created		Net Protected, or Restored Acres	Benefited Acres	Estimated Cost (\$)	Cost Per Benefited Acre (\$/Ac)	Comments
			List Projects	Created					
Supporting Projects, Short-Term: Lakes Subbasin (Continued)									
PME-15	Humble Canal	HR		1,392	2,034	700,000	300		
XME-17	North Canal to Mermentau R.	SP		221	241	6,300,000	26,100		
XME-18	Lake Shore Rims	MC		92	92	370,000	4,000		
XME-26	Warren Canal Structure	HR		na	na	[150,000]	na		
XME-27	Seventh Ward Canal Structure	HR		na	na	[150,000]	na		
XME-28	GIWW/Freshwater Bayou	SP		60	60	700,000	11,700		
XME-29	Freshwater Bayou Phase 3	SP		118	118	3,763,000	31,900		
XME-30	Freshwater Bayou Phase 4	SP		36	36	1,138,000	31,600		
XME-31	Freshwater Bayou Phase 5	SP		36	36	1,138,000	31,600		
XME-32	Freshwater Bayou Phase 6	SP		31	31	1,000,000	32,300		
XME-33	Freshwater Bayou Phase 7	SP		25	25	788,000	31,500		
XME-35a	Umbrella Bay	SP		74	78	1,100,000	14,100		
XME-35b	Mallard Bay	SP		74	78	900,000	11,500		
XME-36	Tebo point	VP		9	11	200,000	18,200		
XME-37	Chenier DuFond	VP		15	18	840,000	46,700		
XME-38	Grand Volle Lake to Bear Lake	SP		204	242	1,000,000	4,100		
XME-40	N. Little Pecan Bayou	HR, SP		117	767	1,400,000	1,800		
XME-43	Florence Canal	HR		500 *	500	350,000	700		
XME-44	GIWW Bank Stabilization	SP		20	23	620,000	27,000		
XME-45	Pumpkin Ridge Structure	HR		15	136	700,000	5,100		
Subtotal Supporting Projects, Short-Term, Lakes Subbasin				6,570	12,500	48,666,000		Does not include Demo PME-06	

Table 4. Summary of the Mermentau Basin Projects (Continued)

Project No.	Project Name	Project Type	Priority Acres Created		Net Benefited Acres	Estimated Cost (\$)	Cost Per Benefited Acre (\$/Ac)	Comments
			List Projects	Protected, or Restored				
<u>Supporting Projects, Short-Term: Chenier Subbasin</u>								
PME-02	Rockefeller Gulf Shoreline	SP		850	913	9,000,000	9,900	
PME-09	Mermentau R. to Rockefeller	SP		418	450	4,200,000	9,300	
XME-22	Pecan Island Terracing	T		23	1,017	1,700,000	1,700	
XME-46	Rollover Bayou Structure	HR		150	601	400,000	700	
Subtotal Supporting Project, Short-Term, Chenier Subbasin				1,440	2,980	15,300,000		Does not include Demo ME-08
<u>Supporting Projects, Long-Term: Lakes Subbasin</u>								
PME-08	Miami South levee	HR				[2,380,000]		
PME-10	Little Pecan Is. Veg. Plantings	VP				[300,000]		
PME-11	GIWW Veg. Plantings	VP				[800,000]		
PME-16	Coteau Plateau Marsh	MM				[900,000]		
XME-34	Oak Grove Canal	FD				[572,000]		
XME-39	Mud Lake Levee Repair	HR				[750,000]		
XME-41	Grand Chenier Levee	HR				[900,000]		
<u>Demonstration Project: Lakes Subbasin</u>								
PME-06	White Lake South Shore	SP	PPL3	16	18	92,000	5,100	Supporting, short-term
<u>Demonstration Projects: Chenier Subbasin</u>								
ME-08	Dewitt Rollover, Veg Planting	VP	PPL1	310	331	271,000	800	Critical, short-term
Total Mermentau Basin **				9,860	20,890	72,929,000		
na Information not available								SP Shoreline or Bank Protection
FD	Freshwater Diversion	MM	Marsh Management					VP Vegetative Planting
HIR	Hydrologic Restoration	HR	Terracing					
[#] Not included in totals.								
* Benefits not verified by the WVA work group.								
**Total cost and benefits for the basin plan include only those for Critical Short-Term Projects, Supporting Short-Term Projects, and Demonstration Projects.								

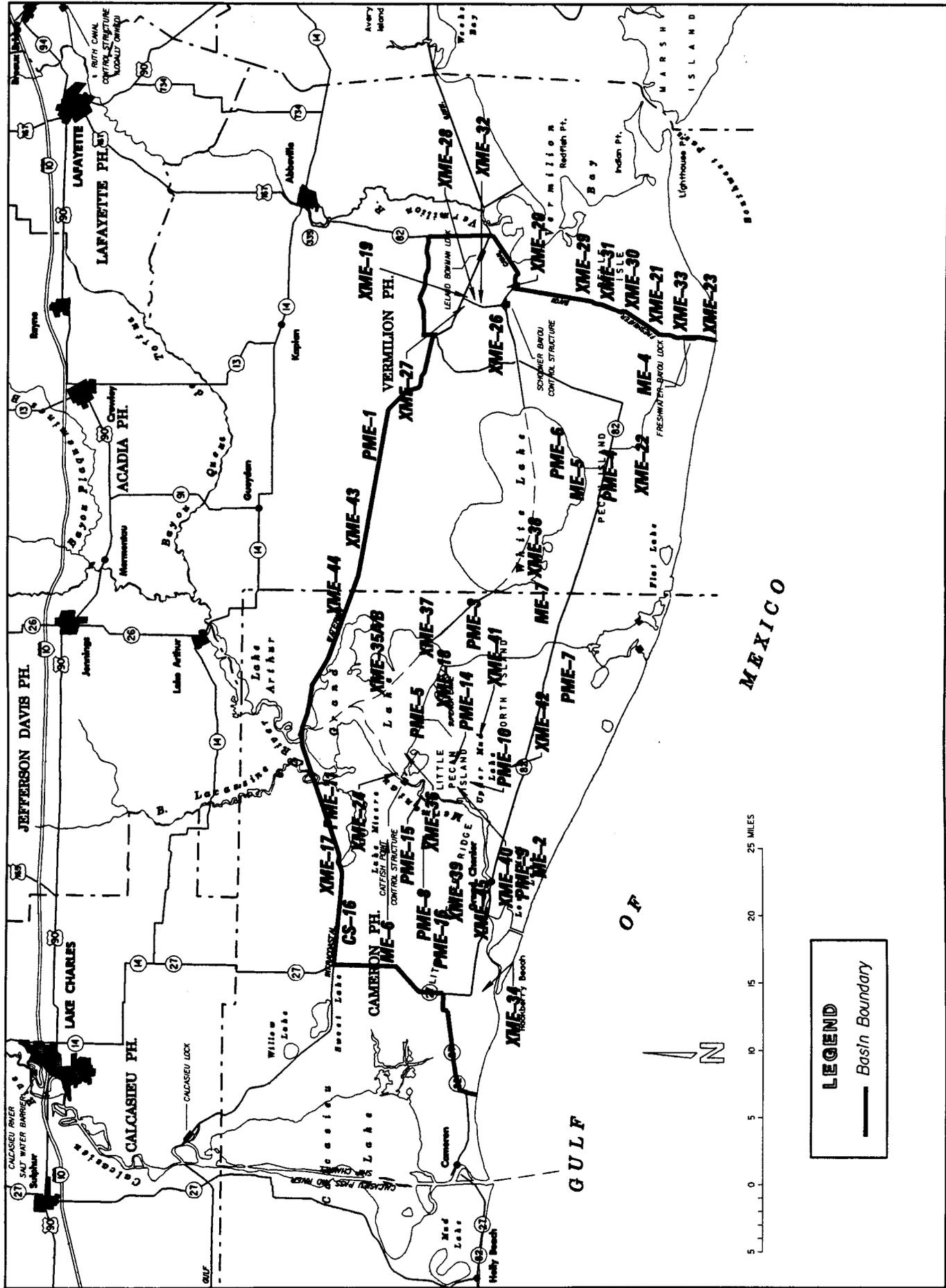


Figure 5. Mermentau Basin, Projects Location.

## IMPLEMENTATION

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### CRITICAL SHORT-TERM PROJECTS

The projects listed below by subbasin are critical to addressing the basin objectives through strategies 1, 2, and 3. The four projects in the Lakes Subbasin would lower water levels and reduce stress on interior wetlands. Projects in the Chenier Subbasin would restore freshwater input restricted by highway embankments, provide additional nutrients and sediment to receiving wetlands, and remove water from the Lakes Subbasin.

#### Lakes Subbasin, Hydrologic Restoration.

CS-16	Black-Bayou Structure
XME-19	Old Vermilion Lock Outflow
XME-20	Schooner Bayou Bypass Structure
XME-23	Freshwater Bayou Structure

#### Chenier Subbasin, Freshwater Diversion.

PME-4	White Lake Diversion
PME-7	Grand/ White Lake Diversion
XME-42	Hog Bayou Freshwater Introduction

### SUPPORTING SHORT TERM PROJECTS

Supporting projects are those that meet the basin strategies 4 and 5 by reducing interior wetland loss, rebuilding of wetlands in open water areas, and maintaining the geologic framework of the basin. Some projects would restore the hydrology in the Little Pecan Bayou and Rollover Bayou areas and enhance wetland creation south of Pecan Island and in the Big Burn area. Other projects would address shoreline erosion in the Grand and White Lakes areas and the Gulf of Mexico and bank erosion on Freshwater Bayou.

#### Lakes Subbasin, Shoreline Protection.

ME-4	Freshwater Bayou Wetlands/Bank Protection
ME-5	White Lake Shore Protection
ME-9	Cameron Prairie Refuge
PME-1	GIWW Bank Protection
PME-3	Old GIWW Bank Protection
PME-5	Grand Lake South Shore
PME-6	White Lake South Shore
XME-17	North Canal to Mermentau River
XME-28	GIWW/Freshwater Bayou
XME-29	Freshwater Bayou Phase 3
XME-30	Freshwater Bayou Phase 4
XME-31	Freshwater Bayou Phase 5
XME-32	Freshwater Bayou Phase 6
XME-33	Freshwater Bayou Phase 7
XME-35A	Umbrella Bay
XME-35B	Mallard Bay
XME-36	Tebo Point
XME-37	Chenier DuFond

XME-38 Grand Volle Lake  
XME-44 GIWW Bank Stabilization

Lakes Subbasin. Hydroloecic Restoration.

PME-14 Sawmill Canal  
PME-15 Humble Canal  
XME-26 Warren Canal Plug  
XME-27 Seventh Ward Canal Plug  
XME-40 N. Little Pecan Bayou  
XME-43 Florence Canal  
XME-45 Pumpkin Ridge Structure

Lakes Subbasin. Wetland Management.

ME-2 Hog Bayou Wetland

Lakes Subbasin. Wetland Creation.

ME-6 Big Burn Marsh Creation  
ME-7 Deep Lake Marsh Protection  
XME-18 Lake Shore Run

Chenier Subbasin. Shoreline Protection.

PME-2 Rockefeller Gulf Shoreline  
PME-9 Mermentau River to Rockefeller

Chenier Subbasin. Hydroloecic Restoration.

XME-46 Rollover Bayou Structure

Chenier Subbasin. Wetland Creation.

PME-22 Pecan Island Terracing

Chenier Subbasin. Vegetation Plantings.

ME-8 Gulf Shoreline Vegetative Plantings

SUPPORTING LONG-TERM PROJECTS

Projects in this category would not have a significant impact on wetland loss, but would enhance the overall wetland resources of the basin.

LAKES SUBBASIN. Hydroloecic Restoration.

PME-8 Miami South Levee  
PME-16 Coteau Plateau Marsh  
XME-39 Mud Lake Levee  
XME-41 Grand Chenier Levee

Lakes Subbasin. Vegetative Plantings.

PME-11 Little Pecan Island  
GIWW Vegetative Plantings

## IMPLEMENTATION

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### Chenier Subbasin, Hydrologic Restoration.

XME-34                      Oak Grove Canal

## COST AND BENEFITS OF THE SELECTED PLAN

### LAKES SUBBASIN

Implementation of the 30 evaluated projects in the selected plan (critical and supporting short-term projects) will protect, create and restore 6,710 acres of wetlands and decrease marsh losses over a period of twenty years by an estimated 27 percent at a cost of approximately \$53,358,000. Three critical hydrologic restoration projects in the subbasin were not evaluated for cost or habitat benefits and will require further study and evaluation. The project benefits for these projects will depend on the ability to reduce the water levels in the subbasin. Additional projects will need to be evaluated for the subbasin for protection of acreage not covered under the present plan.

### CHENIER SUBBASIN

The selected plan is expected to create, protect and restore 3,150 acres of wetlands and reduce marsh loss over a period of twenty years by 22 percent at a cost of approximately \$19,571,000. One project was not evaluated for cost or habitat benefits and will require further study and evaluation. There is a need to develop and evaluate other projects to achieve no net loss of wetlands. If dredging technology becomes more cost-effective, the option of pumping sediments from the gulf into shallow open water or deteriorating marshes will need to be investigated. This can only be used in the more saline subbasin marshes. It should only be done during the spring floods when the gulf salinities are the lowest in order to avoid placing sediments with higher salinities into marsh environments.

## KEY ISSUES IN PLANNING

Key issues concerning plan formulation for the Mermentau Basin are listed and discussed below. The issues range from long range implementation of the selected plan to the diverse demands for basin water and wetland resources.

The present problem in the Lakes Subbasin is flooding, but reducing water levels in the subbasin could result in an increase in salinities in the Grand and White Lakes system.

The Grand and White Lakes system is used by a diverse group with conflicting opinions regarding the operations of existing structures. Rice and crawfish farmers favor high levels of fresh water to insure an adequate supply of irrigation water. Ranchers favor lower water levels to reduce pasture flooding. Commercial fishermen are interested in improved fisheries access. Waterfowlers are interested in varied water levels that would permit seasonal drying out of the marsh to promote the growth of emergent and submergent vegetation. Oil companies need navigation to oil and gas wells in the lakes.

Upstream development coupled with relative sea level rise has greatly reduced the ability of existing water control structures to maintain a stable water level of 2.0 ft. Mean Low Gulf. Changes in operational procedures of existing structures may not produce the desired results and additional structures may be needed.

The cost of implementing the selected plan is approximately \$72,729,000. Thus, funding other than the Coastal Wetlands Planning, Protection and Restoration Act will be required in order to implement all the projects in the selected plan.

Installation and operation of water control structures could reduce recruitment of estuarine-dependent organisms into actively managed marshes, thereby possibly reducing fisheries productivity. Management would hopefully sustain a high level of productivity; without management, productivity would-decrease as marshes continue to be lost.



PROJECTS DESCRIPTIONS

SHORT TERM CRITICAL PROJECTS

CS-16 BLACK BAYOU BYPASS

Location

The project is located in Cameron Parish, Louisiana (Figures 5 & 6) within the Lakes Sub-basin. It is bounded by the GIWW on the north, LA Highway 27, and LA Highway 384 on the west, Little Chenier Ridge on the south and Grand Lake to the east. The project area is comprised of 107,119 acres of fresh to intermediate marsh, open water, and bottomland hardwood forest.

Problems and Opportunities

The project area is impounded due to perimeter highways and levees. An opportunity exists to improve vegetated wetlands by reducing water levels. The reduction in water levels will allow for increased production of emergent marsh and improved productivity of submerged aquatic vegetation. The project fits the overall basin strategy by developing additional outlets to outside channels or water bodies. The project is offensive in nature since it is a freshwater diversion that diverts water from the unit.

Description of Features

The project proposes the use of five 10' x 10' gated box culverts under LA Highway 384 that will be opened when permitted by tidal actions on the Calcasieu Lake in order to reduce water levels in the project area. The operation scheme will allow for removal of freshwater from the Lakes Sub-basin whenever water levels outside of the project area are lower than inside of the unit. It is listed as a freshwater diversion because it diverts freshwater out of the unit.

Benefits and Costs

Rapid protocol Wetland Value Assessment indicates that the project will protect 115 acres of emergent vegetated marsh and enhance marsh and aquatic vegetation by 1,546 acres for a net benefit of 1,661 acres. The estimated cost of the project is \$6,419,000.

Effects and Issues

The project will reduce some of the impoundment problems associated with the Lakes Sub-basin and help to improve area hydrology in the Grand/White Lakes system. There are no known major issues to be resolved at the time of this writing.

Status

This project is presently listed in the State of Louisiana Coastal Wetlands Conservation and Restoration Program. The project was proposed for the 3rd Priority Project List, but was not selected in comparison to other presented projects. A feasibility study is required to determine the viability of the project in reducing water levels within the Lakes Sub-basin.

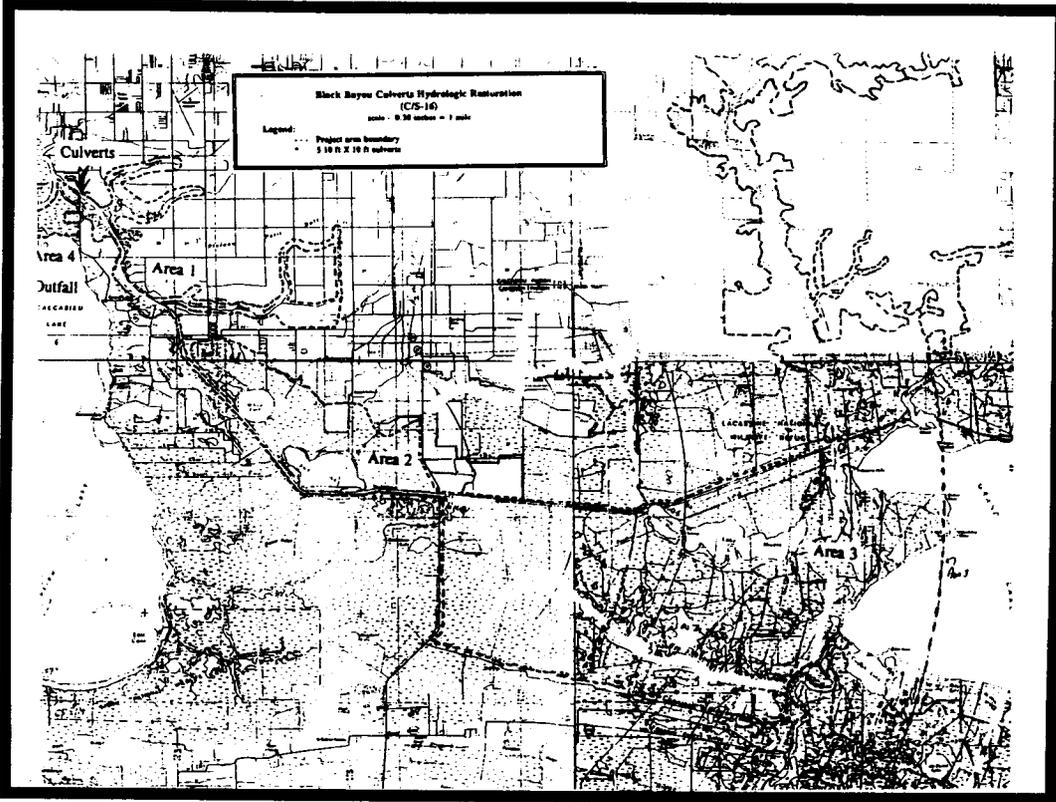


Figure 6. (CS-16) Black Bayou Bypass

## PME-4 WHITE LAKE DIVERSION

### Location

The project is located in Vermilion Parish, Louisiana (Figures 5 & 7) within the Chenier Sub-basin. It is bounded by Pecan Island Ridge on the north, the Gulf of Mexico on the south, Rollover Bayou on the west and an unnamed pipeline canal on the east. The project area comprises approximately 14,682 ac. of brackish marsh and open water habitat.

### Problems and Opportunities

High water levels in the Lakes Sub-basin are stressing marsh vegetation while marshes in the Chenier Sub-basin are suffering from saltwater intrusion. An opportunity exists to improve vegetated wetlands by reducing water levels. The reduction in water levels will allow for increased production of emergent marsh and improved productivity of submerged aquatic vegetation. The project fits the overall basin strategy by developing additional outlets to outside channels or water bodies. The project is offensive in nature since it is a freshwater diversion that diverts water into the Chenier Sub-basin.

### Description of Features

The project remains conceptual in nature but proposes the use of several culverted structures under LA Highway 82 or siphons with booster pumps over the highway in order to introduce freshwater into the Chenier Sub-basin. The operation scheme will allow for removal of freshwater from the Lakes Sub-basin whenever water levels outside of the project area are lower than inside of the unit. It is listed as a freshwater diversion because it diverts freshwater out of the unit.

### Benefits and Costs

The project is expected to protect 126 acres of emergent marsh, enhance 419 acres of marsh, and create 588 acres of submerged aquatic vegetation for an overall benefit of 1,133 acres as calculated by the CWPPRA WVA Working Group. Some sediment would be introduced into the area and shoreline erosion along White Lake would be somewhat reduced. The gross estimated cost of the project is \$2.0 million.

### Effects and Issues

The project will reduce some of the salinity problems in the Chenier Sub-basin and also reduce some of the water level problems associated with the Lakes Sub-basin thereby increasing marsh productivity in both sub-basins. It is probable that traffic along Hwy. 82 will be disrupted during construction. No other adverse impacts are anticipated at the time of this writing.

### Status

A similar project is already in place and operating since 1992 that was constructed as part of the Louisiana State Coastal Wetland Conservation and Restoration Plan. That project is called (ME-1) Pecan Island Freshwater Introduction.. It is conceivable that this project may expand on ME- 1. A feasibility study is needed for this project. It may be a candidate for future priority lists.

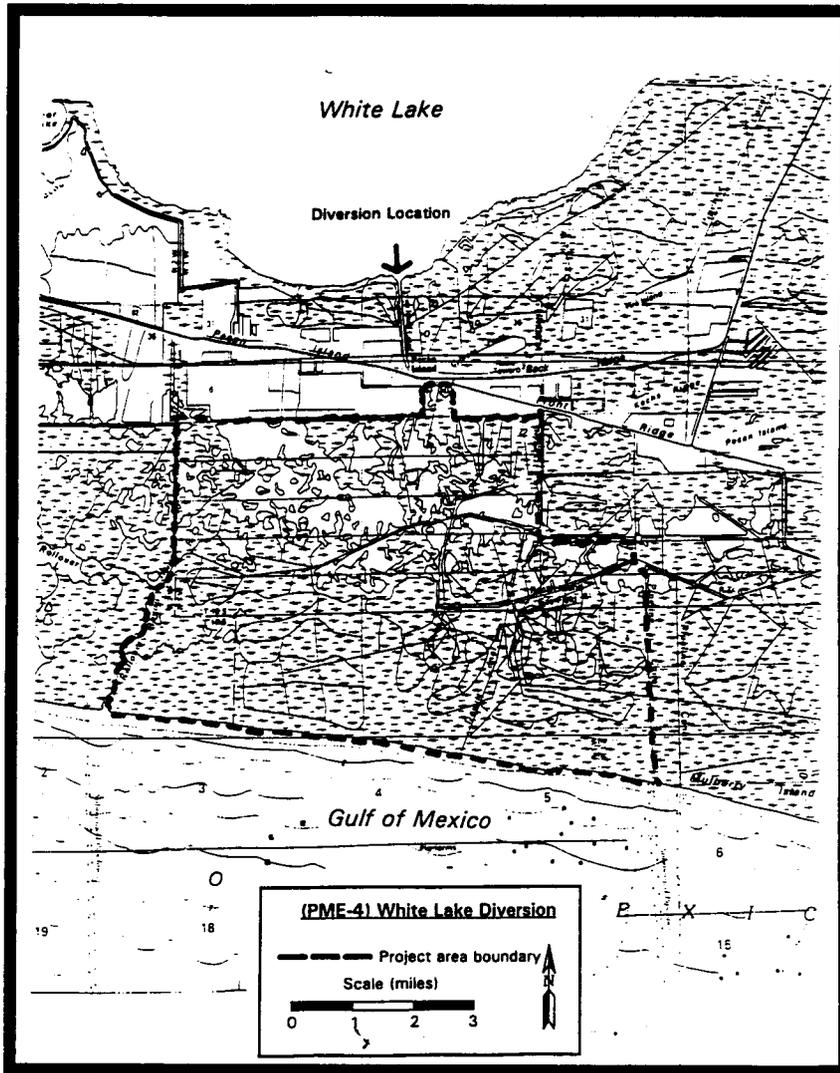


Figure 7. (PME-4) White Lake Diversion

PME-7 GRAND/WHITE LAKES DIVERSION

Location

The project is located in Cameron and Vermilion Parishes, Louisiana and for all practical purposes includes the entire basin.

Problems and Onnortunities

High water levels in the Lakes Sub-basin are stressing marsh vegetation while marshes in the Chenier Sub-basin are suffering from saltwater intrusion. An opportunity exists to improve vegetated wetlands in the Lakes Sub-basin by reducing water levels and at the same time ameliorate saltwater intrusion in the Chenier Sub-basin by introducing additional freshwater from the Lakes Sub-basin. The reduction in water levels will allow for increased production of emergent marsh and improved productivity of submerged aquatic vegetation. This is a broad scope project addressing the basin strategy of seeking opportunities to lower water levels in the Lakes Sub-basin wherever they may exist. In this sense, it is a project that will include water diversions at multiple locations and changes in the operating schedules for existing water control structures basin-wide.

Description of Features

The project proposes to seek out and evaluate means of lowering water levels in the Lakes Sub-basin wherever they may exist. The project will, in all likelihood, involve water diversions at several locations throughout the basin and changes in the operational schedules of existing water control structures.

Benefits and Costs

Valid acreage benefits of this project are unavailable at the time of this writing and due to the broad scope of this project, cost is uncertain.

Effects and Issues

The project will reduce salinity problems in the Chenier Sub-basin and also reduce water level problems associated with the Lakes Sub-basin. No adverse effects are known at this time.

Status

This project is conceptual and requires study to determine project feasibility. It may be a candidate for future priority lists.

## SHORT TERM CRITICAL PROJECTS

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### XME-19 OLD VERMILION LOCK OUTFLOW

#### Location

The project is located in Vermilion Parish, Louisiana (Figures 5 and 8) within the Chenier Sub-basin. The Vermilion Lock is located on the Gulf Intracoastal Waterway approximately three miles west of Intracoastal City. Project area boundaries and acreage are not finalized at the time of this writing.

#### Problems and Opportunities

High water levels in the Lakes Sub-basin are stressing marsh vegetation while marshes in the Chenier Sub-basin are suffering from saltwater intrusion. An opportunity exists to improve vegetated wetlands by reducing water levels. The reduction in water levels will allow for increased production of emergent marsh and improved productivity of submerged aquatic vegetation. The project fits the overall basin strategy by utilizing existing structures in Sub-basin in order to reduce water levels on stressed interior marshes. The project is offensive in nature since it is a freshwater diversion that diverts water out of the Lakes Sub-basin.

#### Description of Features

The project proposes the modification of an existing structure under LA Highway 82 in order to improve the introduction of freshwater into the Chenier Sub-basin. The operation scheme is to modify lock operation in order to allow for removal of freshwater from the Lakes Sub-basin whenever water levels outside of the lock are lower than inside of the unit. It is listed as a freshwater diversion because it diverts freshwater out of the unit.

#### Benefits and Costs

The project does not have the acreage benefit or costs of implementation calculated at the present time.

#### Effects and Issues

The project will reduce some of the salinity problems in the Chenier Sub-basin and also reduce some of the water level problems associated with the Lakes Sub-basin. The has no major issues to be resolved in order to be implemented.

#### Status

A feasibility study is needed to calculate project viability along with acreage benefits and costs. It may be a candidate for future priority lists.

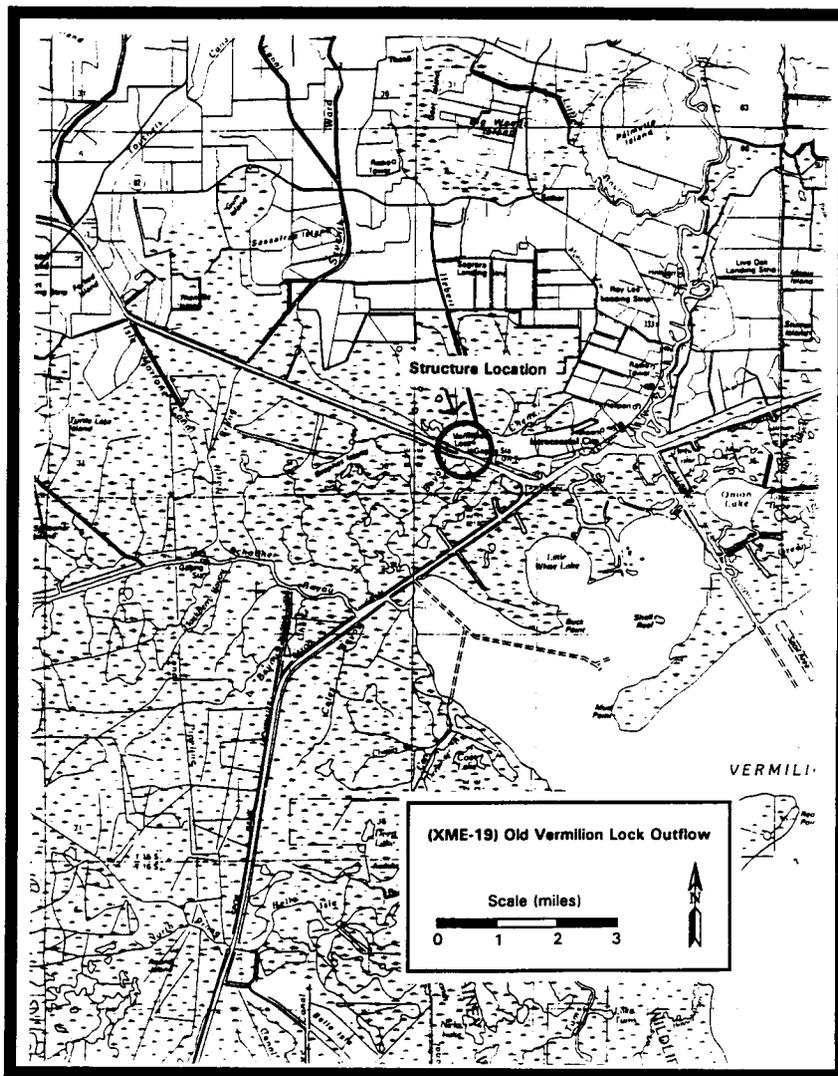


Figure 8. (XME-19) Old Vermilion Lock Outflow

## SHORT TERM CRITICAL PROJECTS

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### XME-20 SCHOONER BAYOU BYPASS STRUCTURE

#### Location

The project is located in Vermilion Parish, Louisiana (Figures 5 and 9) within the Lakes Sub-basin at the Old Vermilion Locks/Schooner Bayou Bypass Structure 3 miles west of Intracoastal City. The present structure is sometimes utilized to manipulate water levels in the Old Intracoastal Waterway and in White Lake. Project area boundaries and benefited acreage are not finalized at the time of this writing.

#### Problems and Opportunities

The project will benefit wetlands in the basin area by moving freshwater from the Lakes Sub-basin into the Chenier Sub-basin. The reduction in water levels will allow for increased production of emergent marsh and improved productivity of submerged aquatic vegetation. The project fits the overall basin strategy by managing existing structures in the Sub-basin to relieve water stress on interior wetlands. The objective of this project is to construct an automatic water level pump station that would operate whenever levels within the system, (i.e. west of the lock) are higher than water levels outside or east of the lock. Such operation would help maintain consistent water levels in White Lake and aid in generally lowering the water level in the lake. Reducing the lake level fluctuations and lowering lake levels would significantly aid the wetlands surrounding the lake, which tend to be more flooded than they were under totally natural conditions circa the 1920's.

#### Description of Features

The three siphon pipe water level/pump system calls for two digital water level recorders, one on either side of the lock. These recorders will be connected to a microprocessor that will ensure that when water levels outside the lock are lower than inside, the pumps will operate. Software within the microprocessor will allow three pumps to operate independently of each other and the pumping program to be modified to meet managers needs. The system as proposed would be very efficient and would not require hands-on operation. Maximum discharge would be 300 cubic feet per second (cfs).

#### Benefits and Costs

Preliminary estimates indicate the cost of the project will be on the order of \$468,400. Acreage benefits have not been determined.

#### Effects and Issues

The project will reduce some of the salinity problems in the Chenier Sub-basin and also alleviate some of the water level problems associated with the Lakes Sub-basin. No adverse impacts are anticipated at the time of this writing.

#### Status

A feasibility study is needed to calculate project viability along with acreage benefits and costs. It may be a candidate for future priority lists.

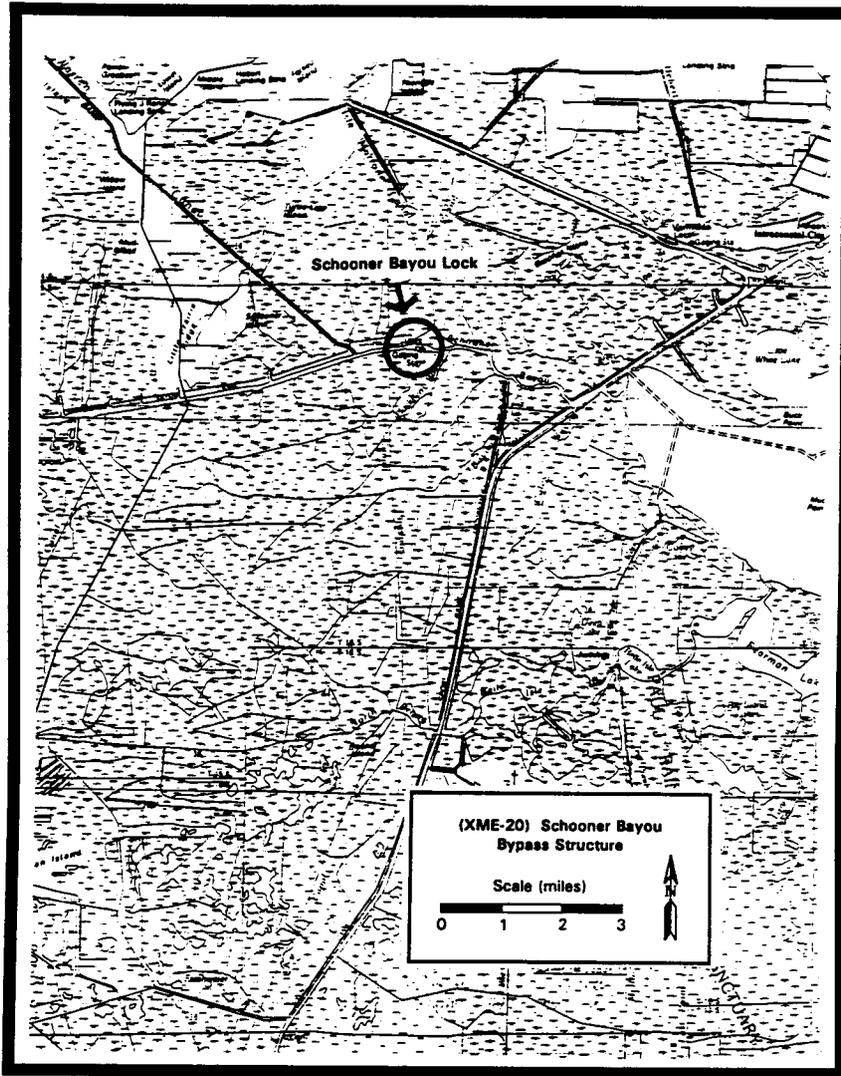


Figure 9. (XME-20) Schooner Bayou Bypass Structure

### XME-23 FRESHWATER BAYOU STRUCTURE

#### Location

The project is located in Vermilion Parish, Louisiana within the Lakes Sub-basin near the mouth of the Freshwater Bayou Canal at the Freshwater Bayou Lock (Figures 5 & 10).

#### Problems and Opportunities

High water levels in the Lakes Sub-basin are stressing marsh vegetation while marshes in the Chenier Sub-basin are suffering from saltwater intrusion. An opportunity exists to improve vegetated wetlands in the Lake Sub-basin by reducing water levels by modifying the operational schedule of the Freshwater Bayou Canal Lock. Currently the lock is opened only for boat traffic and when water levels in the Lakes Sub-basin are dangerously high. This project proposes that the lock be opened whenever tidal conditions permit, such that tidal flow will draw water out of the Lakes Sub-basin. The reduction in water levels will allow for increased production of emergent marsh and improved productivity of submerged aquatic vegetation. The project fits the overall basin strategy by utilizing existing structures in Sub-basin in order to reduce water levels on stressed interior marshes. The project is offensive in nature since it is a freshwater diversion that diverts water out of the Lakes Sub-basin.

#### Description of Features

The project proposes the modification of the existing operating schedule of the Freshwater Bayou Lock. The operational scheme is to modify lock operation in order to allow for removal of freshwater from the Lakes Sub-basin whenever water levels outside of the lock are lower than inside of the unit. It is listed as a freshwater diversion because it diverts freshwater out of the unit.

#### Benefits and Costs

This project will lower water levels in the Lakes Sub-basin and is expected to increase productivity of the marshes for the benefit of wetland dependent fish and wildlife populations. The project does not have the acreage benefit or costs of implementation calculated at the present time.

#### Effects and Issues

The project will reduce water level problems associated with the Lakes Sub-basin. Ingress and egress of estuarine fisheries will increase with this project. No adverse impacts are anticipated so long as the lock is operated properly.

#### Status

This project is conceptual and a feasibility study is needed to calculate project viability along with acreage benefits and costs. It may be a candidate for future priority lists.

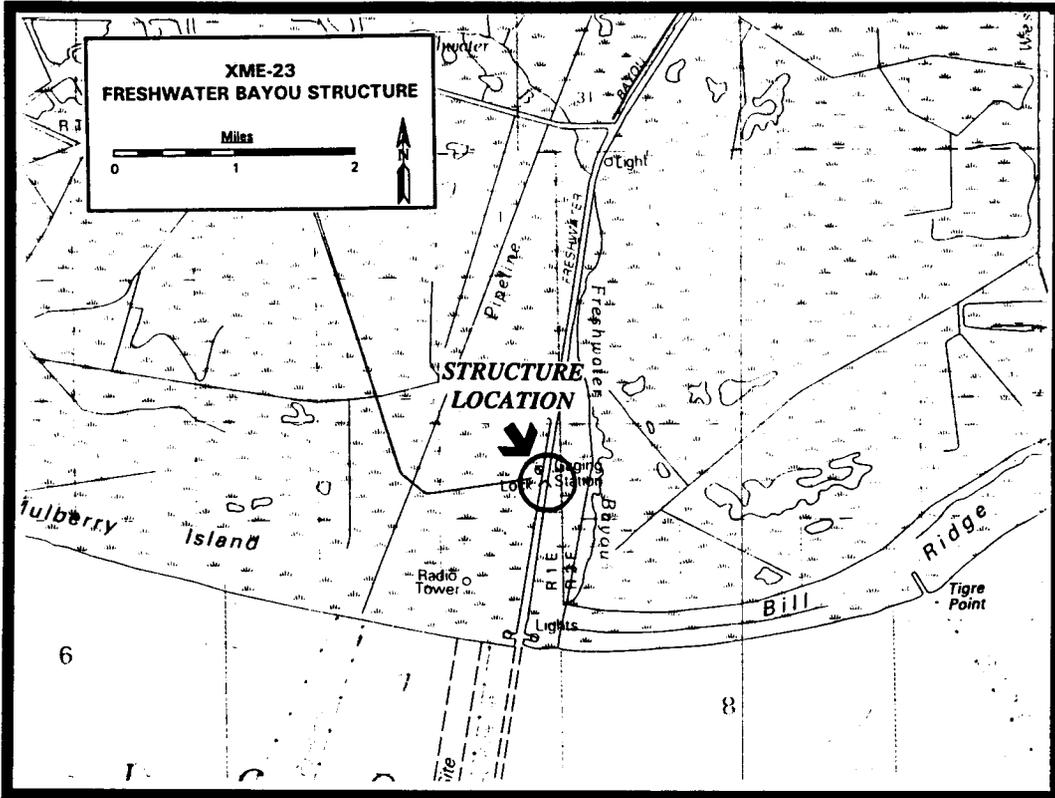


Figure 10. (XME-23) Freshwater Bayou Structure

## SHORT TERM CRITICAL PROJECTS

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### XME-42 HOG BAYOU FRESHWATER INTRODUCTION

#### Location

The project is located in both Sub-basins in Cameron Parish, Louisiana (Figures 5 7 11). The project area begins on the north by Little Pecan Bayou, thence east to an unnamed oil field canal southeast of Little Pecan Lake, thence south to the Grand Chenier Ridge, thence west to Nunez Landing, thence south to the Gulf of Mexico, thence 8 miles west to an unnamed oil field canal, thence north to Grand Chenier, thence east along LA 82 to the western side of the Grand Chenier Protection Levee, thence north 4 miles and west 3 miles to Upper Mud Lake, thence north to Little Pecan Bayou.

#### Problems and Opportunities

High water levels in the Lakes Sub-basin are stressing marsh vegetation while marshes in the Chenier Sub-basin are suffering from saltwater intrusion. An opportunity exists to improve vegetated wetlands in the Lake Sub-basin by reducing water levels by diverting some of the water into the Chenier Sub-basin. This project proposes to do this by diverting water from the marsh between Little Pecan Bayou and the Grand Chenier Ridge into the marsh south of the Grand Chenier Ridge and LA 82. The project fits the overall basin strategy by utilizing existing structures in Sub-basin in order to reduce water levels on stressed interior marshes. The project is offensive in nature since it is a freshwater diversion that diverts water out of the Lakes Sub-basin.

#### Description of Features

Water from the Lakes sub-basin in the vicinity of the Grand Chenier Ridge and Little Pecan Bayou will be diverted via a canal adjacent to the Grand Chenier Protection Levee into the marshes south of the Grand Chenier Ridge. Detailed information on the project is unavailable as of the time of this writing.

#### Benefits and Costs

Rapid assessment WVA protocol indicates that the project will protect 1,274 acres of emergent vegetated marsh and will benefit 2,264 acres. The estimated cost of the project is \$2.0 million with a cost-effectiveness of \$883 per benefited acre.

#### Effects and Issues

The project will reduce some of the salinity problems in the Chenier Sub-basin and also reduce some of the water level problems associated with the Lakes Sub-basin. The project has no major issues to be resolved in order to be implemented.

#### Status

This project is conceptual and requires feasibility study. It may be a candidate for future priority lists.

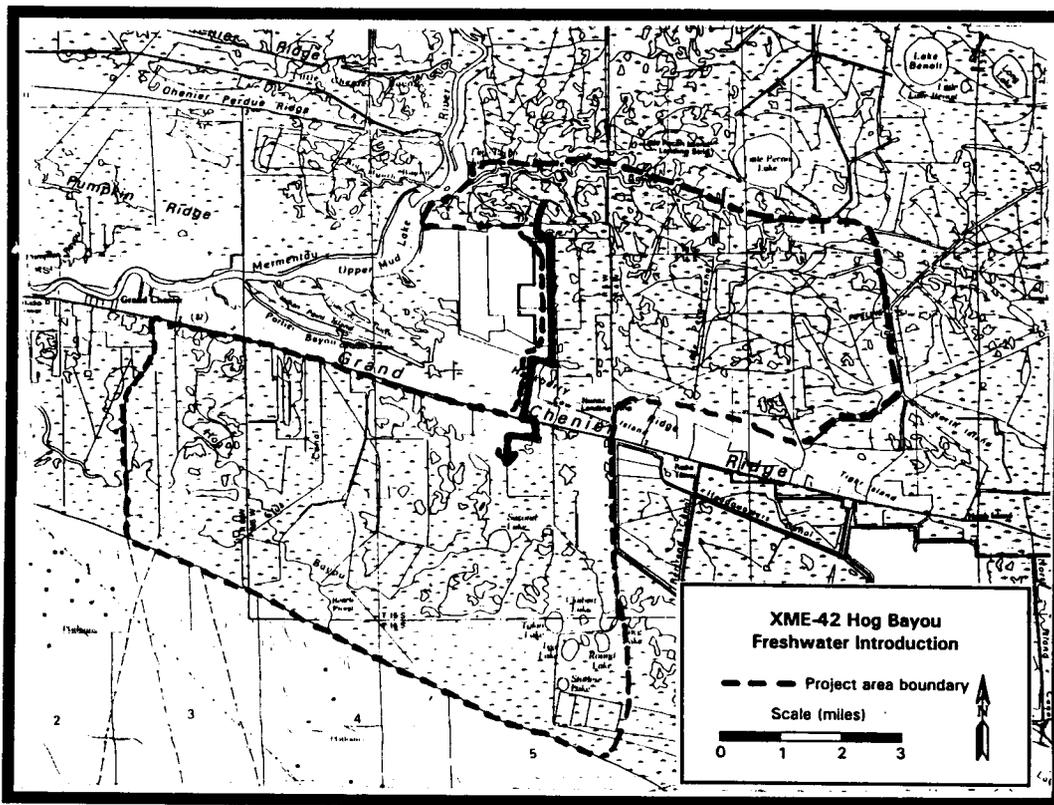


Figure 11. (XME-42) Hog Bayou Freshwater Introduction.

## SHORT TERM SUPPORTING PROJECTS

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### SHORT TERM SUPPORTING PROJECTS

#### ME-8 DEWITT ROLLOVER VEGETATIVE PLANTINGS

##### Location

The project is located in Vermilion Parish, Louisiana (Figures 5 & 12) within the Chenier Sub-basin on the Gulf of Mexico shoreline. It is bounded on the east by Rollover Bayou, west by Dewitt Canal.

##### Problems and Opportunities

Sediments transported by longshore drift from the prograding Atchafalaya delta are building new land along the chenier plain in this project area. Currently, there are wide deposits of semiconsolidated and unconsolidated silts and clays that are gradually being colonized by smooth cordgrass. This project will provide information on the physical interaction between plants and rapidly accreting substrates, thus, providing possible future options for managing accreting shorelines in Louisiana. The project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels. The objectives of the project are to: (1) provide a model for monitoring transport and capture of particles by plant communities in accreting marsh environments and (2) monitor the effectiveness of marsh plants to affect depositional conditions by obtaining data about impact of vegetation on current velocity, sedimentation rate, and sediment retention.

##### Description of Features

Twelve thousand trade gallon size containers of smooth cord grass ***Spartina alterniflora*** will be planted along an accreting mudflat environment for a distance of approximately one mile west of Dewitt Canal.

##### Benefits and Costs

Wetland Value Assessment data indicate that the project will create and protect 3 10 acres of marsh and enhance 21 acres of marsh and aquatic vegetation at a cost of \$271,000.

##### Effects and Issues

This project will accelerate accretion and stabilization of sediment carried by longshore drift in this area. New wetland will be created for the benefit of wetland dependent fish and wildlife populations. No adverse impacts will result from this project.

##### Status

This project is presently listed in the State of Louisiana Coastal Wetlands Conservation and Restoration Program. This project was funded in 1991 on the CWPPRA first priority list as on of the Statewide Vegetative Plantings projects. Planting is expected to begin in the Spring of 1994.

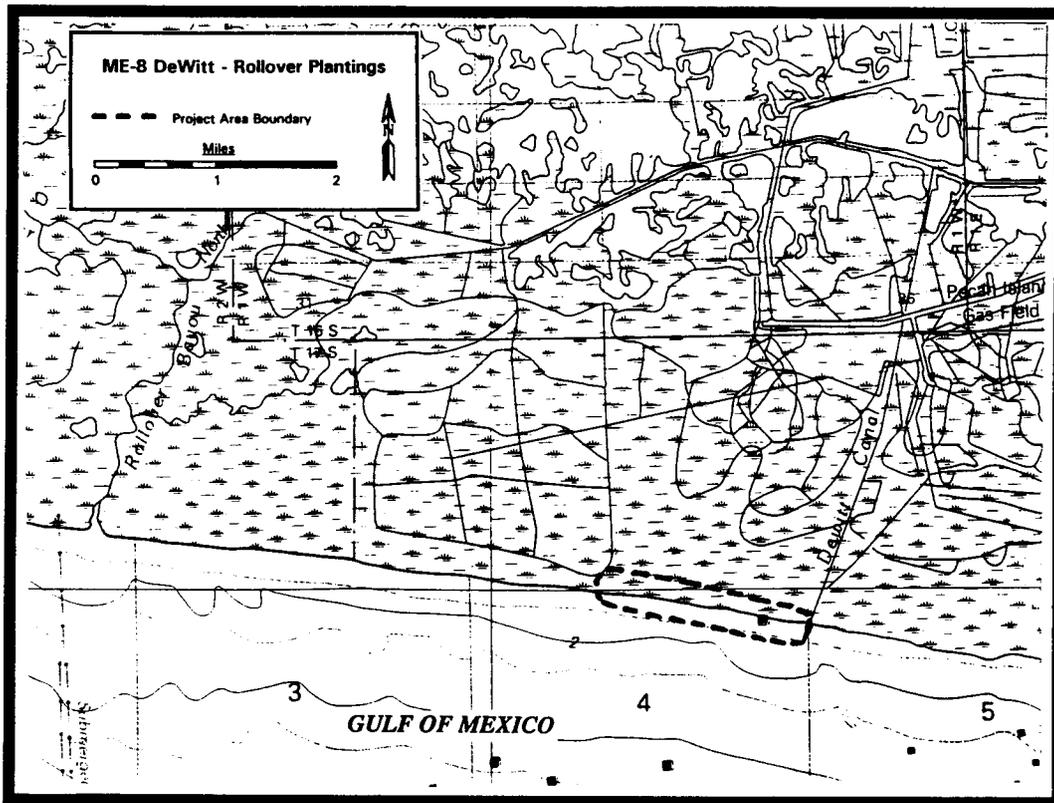


Figure 12. (ME-8) Dewitt - Rollover Vegetative Plantings

## SHORT TERM SUPPORTING PROJECTS

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### ME-9 CAMERON PRAIRIE REFUGE

#### Location

The project is located in Cameron Parish, Louisiana (Figures 5 & 13) within the Lakes Sub-basin inside the Cameron Prairie National Wildlife Refuge (NWR) approximately 25 miles southeast from Lake Charles. The project area is comprised of 640 acres of fresh marsh and open water habitat.

#### Problems and Opportunities

The southern boundary of the project area is the north bank of the Gulf Intracoastal Waterway (GIWW). The northern bank of the waterway has eroded badly, eliminating much of the original spoil bank that protected the freshwater wetlands to the north. As a result, marsh is being eroded leaving shallow open water habitat adjacent to the GIWW. This project will construct a protection levee along the north bank of the GIWW. The project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels. There are three major objectives of this project. (1) Protection of emergent wetlands of the Cameron Prairie NWR. (2) Enhancement of emergent wetlands protected by the proposed levee. (3) Terminate the encroachment of the GIWW on the NWR.

#### Description of Features

This project calls for construction of approximately 6,000 feet of rock breakwater along the north bank of the GIWW.

#### Benefits and Costs

Rapid protocol Wetland Value Assessment data indicate that approximately 247 acres of marsh will be protected and 213 acres of marsh and aquatic vegetation will be enhanced by this project at an estimated cost of \$1,109,000.

#### Effects and Issues

The project will halt shoreline erosion along this section of the GIWW thereby protecting fresh marsh for the benefit of wetland dependent fish and wildlife populations.

#### Status

This project is presently listed in the State of Louisiana Coastal Wetlands Conservation and Restoration Program. This project was funded in 1991 on the CWPPRA first priority list. Construction is expected to begin in 1994.

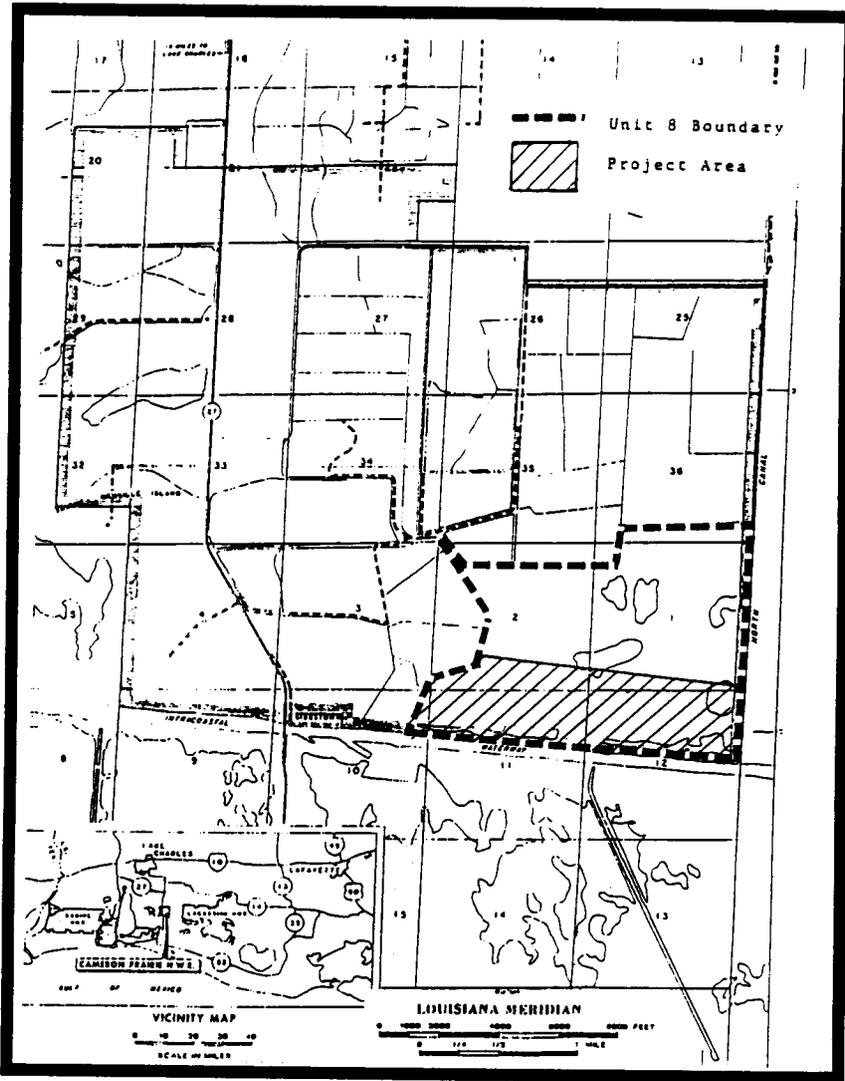


Figure 13. (ME-9) Cameron Prairie Refuge

## SHORT TERM SUPPORTING PROJECTS

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### ME-2 HOG BAYOU WETLAND

#### Location

The project is located in Cameron Parish, Louisiana approximately one mile southwest of the town of Grand Chenier in the Chenier Sub-basin (Figures 5 & 14) The project area encompasses approximately 520 acres of saline marsh habitat and is bound on the north by LA 82, on the east by an oil access road, on the west by an oil access canal and spoil bank, and on the south by natural wetlands and an oil access road.

#### Problems and Opportunities

This area has sustained considerable marsh loss from 1978 to 1985 and has converted from a brackish marsh to a saline marsh. High rates of loss have been attributed to man-made alterations affecting the marsh such as large oil and gas exploration canals and smaller hunter-trapper access trenasses. These canals provide avenues for saltwater intrusion and increased tidal amplitude and turbidity since the Mermentau Ship Channel was excavated in the early 1970's. The most recent data indicate that land loss in the area has slowed such that it is now a fairly stable saline marsh with a slight continuing land loss problem. The objective of the project is to restore brackish marsh habitats thereby increasing diversity and productivity of emergent vegetation and improving the value of the area for wildlife while maintaining important fisheries functions. To achieve those goals a number of measures have been proposed to regain freshwater retention capability, reduce salinities, and provide for draw-down to harden pond bottoms by promoting growth of submerged aquatic vegetation for waterfowl food. This project is compatible with the basin strategy of treating critical areas of wetland loss within the interior of the basin.

#### Description of Features

Two 48 inch flapgated culverts with stop-log bay on the inside are planned for the southeast project area boundary to reduce saltwater intrusion and allow for periodic draw-downs. One additional 48 inch flapgated culvert will serve as a fresh water/sediment introduction structure on the north project boundary to diverts freshwater and sediments from the Mermentau River under LA 82 into the project area. The existing 24 inch culvert under the road on the will be replaced with a 48 inch flapgated culvert. Approximately 2,300 feet of spoil embankment will be constructed along the southern and northwest corner of the project area. In addition two earthen plugs will be constructed and one existing trenasse will be cleaned out to facilitate sediment and fresh water inflow into the area. Water levels will be lowered every fourth year to promote revegetation and productivity of submerged aquatic vegetation.

#### Benefits and Costs

Approximately 20 acres are expected to be protected and 35 acres will be enhanced for a total benefit of 55 acres at an estimated cost of \$336,000.

**Effects and Issues**

This project will increase diversity and productivity of emergent vegetation and improving the value of the area for wildlife while maintaining important fisheries functions. There may be potential for reduced sediment inflow into the project area due to the project. Fisheries movement into and out of the project area will be reduced, however, resident fisheries may be enhanced by the project..

**Status**

This project is presently listed in the State of Louisiana Coastal Wetlands Conservation and Restoration Program. A feasibility study has been completed on this project. Funding and permitting remain to be completed.

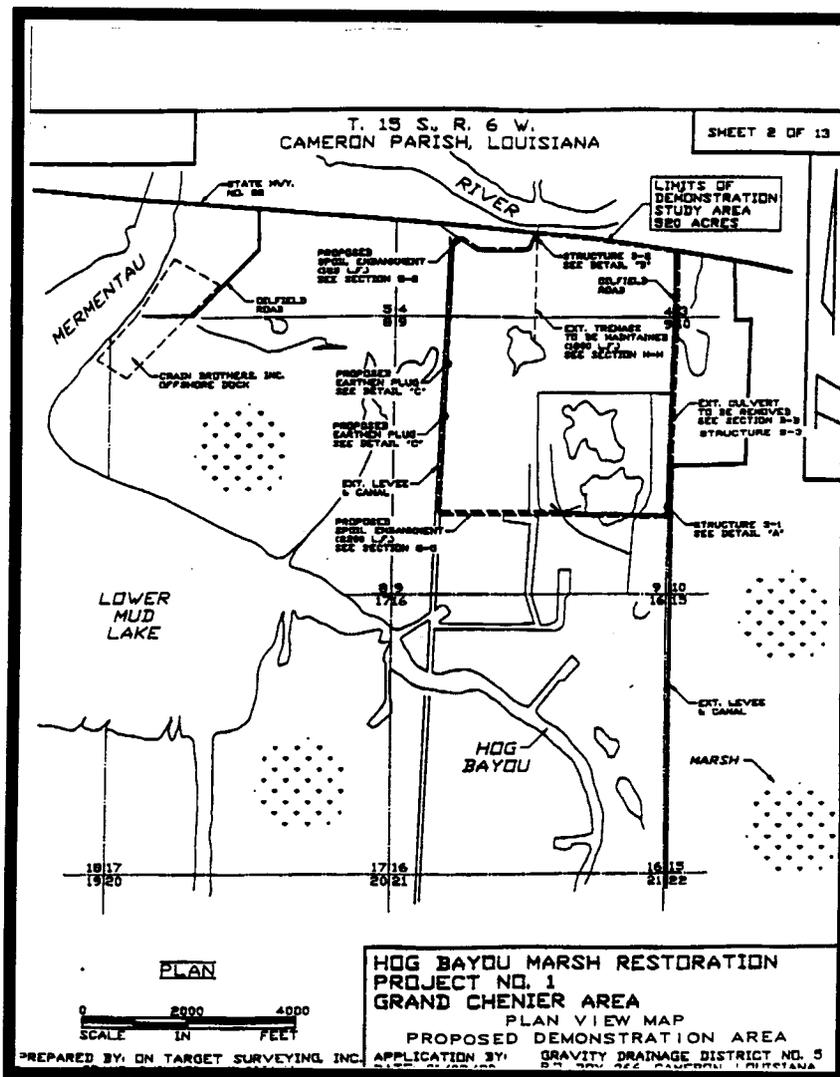


Figure 14. (ME-2) Hog Bayou Wetland

## SUPPORTING SHORT TERM PROJECTS

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### SUPPORTING SHORT TERM PROJECT

#### ME-4 FRESHWATER BAYOU WETLAND

##### Location

The project area is located in the Lakes Sub-basin west of Freshwater Bayou, north of the Acadiana Marina Canal, east of La Hwy. 82, and south of the GIWW, about 8 miles east of Pecan Island, Louisiana in Vermilion Parish (Figures 5 and 15). The 14,381 acre project area includes 11,342 acres (79% of the project area) of intermediate marsh wetlands.

##### Problems and Opportunities

Freshwater Bayou was enlarged to a width of 300 feet to accommodate additional commercial boat traffic. As a consequence, increased tidal exchange, wave action, and wave wash from boat traffic has greatly increased shoreline erosion along Freshwater Bayou Canal, which has expanded in width to almost 600 feet. The existing spoil banks along sections of the channel have been severely eroded allowing tidal scouring and breakup of the adjacent marshes to occur. Without shoreline protection, the channel will continue to widen, consuming additional sections of spoil banks and adjacent marsh in the process.

The project area wetlands have also experienced increased freshwater introduction from White Lake through the borrow canals and culverts along LA Hwy. 82 on the west side of the project area. Once in the project area wetlands, drainage of this fresh water is impeded by the spoil banks along both the Freshwater Bayou Canal and the Acadiana Marina Canal. These result has been increased ponding in the interior marshes of the project area.

The primary objectives of the project are: 1) to stabilize the rapidly eroding west shoreline of Freshwater Bayou Canal and 2) to reduce ponding and marsh loss in the adjacent wetlands. The project is compatible with the basin strategies of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels and treating critical areas of wetland loss within the interior of the basin.

##### Description of Features

Installation of 10,000 linear feet of rock breakwater (rip rap) along the west shoreline of Freshwater Bayou Canal, where needed, to protect this shoreline from further erosion. Gated water control structures will be installed on the Acadiana Marina Canal to reduce ponding in the area known as the Freshwater Bayou Wetlands.

##### Benefits and Costs

Wetland Value Assessment data indicate that this project will protect 1,593 acres of marsh and enhance 2,920 acres of marsh and submerged aquatic vegetation for a benefited acreage of 4,513 acres. The cost of this project is estimated to be \$2,032,000.

**Effects and Issues**

Shoreline stabilization and water control structures will halt or significantly reduce land loss in this area thereby protecting wetland habitat for the benefit of wetland dependent fisheries and wildlife. Estuarine fisheries ingress and egress will be limited by the project although some resident fisheries may be enhanced by the project.

**Status**

This project is presently listed in the State of Louisiana Coastal Wetlands Conservation and Restoration Program. This project was funded on the 1992 second priority list of the CWPPRA. Construction is scheduled to begin in 1996.

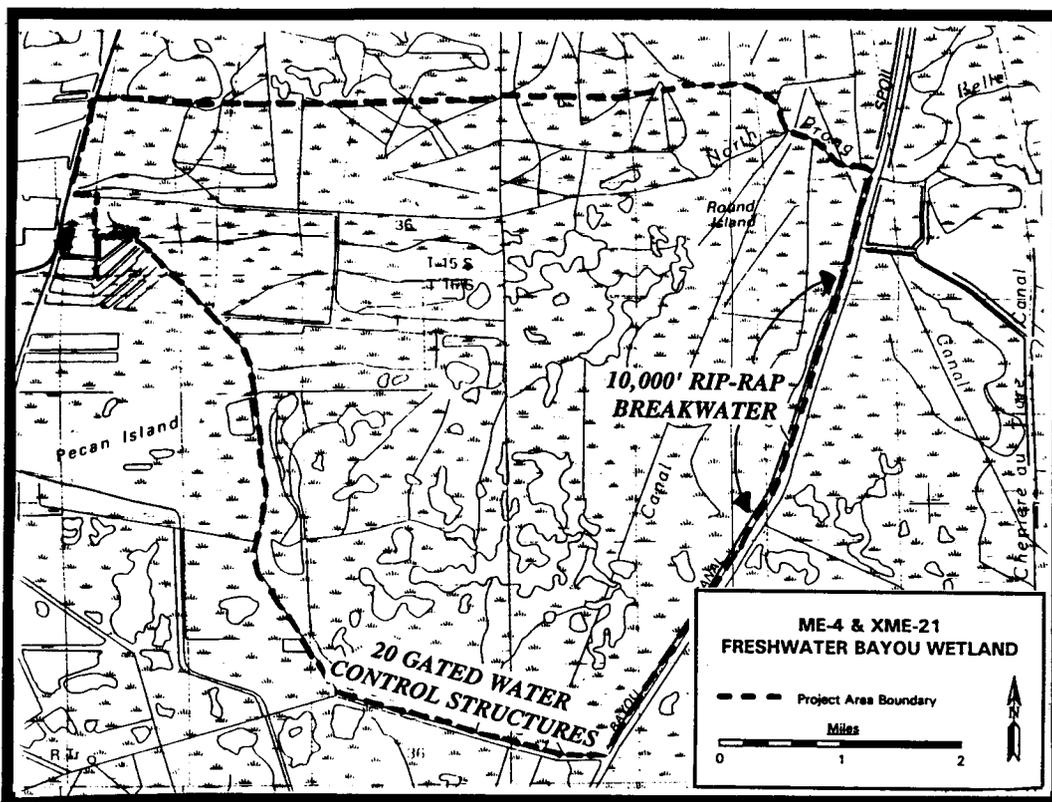


Figure 15. (ME-4) Freshwater Bayou Wetland

## SUPPORTING SHORT TERM PROJECTS

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### ME-5 SOUTH WHITE LAKE SHORE PROTECTION

#### Location

This project is located in the Lakes Sub-basin approximately 8 miles west-northwest of Pecan Island, Louisiana in Vermilion Parish (Figures 5 and 16), the project area includes a strip of approximately 296 acres of fresh and intermediate marsh along approximately 3.5 miles of the southern White Lake shoreline beginning just east of Bear Lake

#### Problems and Opportunities

The White Lake shoreline in the vicinity of Bear Lake has experienced erosion rates of 5.6 - 18.1 ft/yr between 1974 and 1990. A narrow strip of fresh/intermediate marsh varying from about 31-450 feet wide along the Bear Lake shoreline to about 700-1,500 feet wide along the White Lake shoreline presently separates the lakes from an impoundment levee that protects a fresh marsh impoundment. Half of the marsh strip between White Lake and the management levee could be lost in 20 years at present erosion rates.

The objectives of this project are to halt shoreline erosion and protect the existing strip of marsh between the shoreline and the existing impoundment levee and adjacent to Bear Lake. This, in turn, will protect the impoundment levee and the integrity of the fresh marsh impoundment it protects. The project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

#### Description of Features

Approx. 3.5 miles (18,480 ft) of segmented rock breakwater (250 feet long breakwaters with a 25 feet wide gap between each of them) will be installed in White Lake at approx. the 2 feet contour line along the shoreline in the project area.

Suitable emergent marsh plant species will be planted along the edge of the shoreline for stabilization purposes. Approx. 3,696 plugs of plants of suitable marsh species will be planted on five foot centers along the protected section of shoreline for stabilization purposes and to create emergent marsh. As many predator guards as plugs may be needed to prevent herbivory. [Comparison and evaluation of the success and suitability of several plant species for shoreline plantings, for example Giant cutgrass (*Zizaniopsis miliacea*), Roseau cane (*Phragmites australis*), California bullwhip (*Scirpus californicus*), and Soft stem bulrush (*S. validus*) may also be worked into the project design.]

#### Benefits and Costs

Rapid Protocol Wetland Value Assessment data indicate that this project will protect 39 acres of marsh and enhance 104 acres of marsh and submerged aquatic vegetation. The cost of this project is estimated to be \$3,234,000.

**Effects and Issues**

This project will reverse shoreline erosion by promoting sediment deposition behind the breakwater. Vegetative plantings will create new habitat and stabilize the existing and newly created shorelines. Wetland habitat will be preserved and restored thereby benefiting wetland dependent fish and wildlife populations. No adverse impacts are expected.

**Status**

This project is presently listed in the State of Louisiana Coastal Wetlands Conservation and Restoration Program. It may be a candidate for future priority lists.

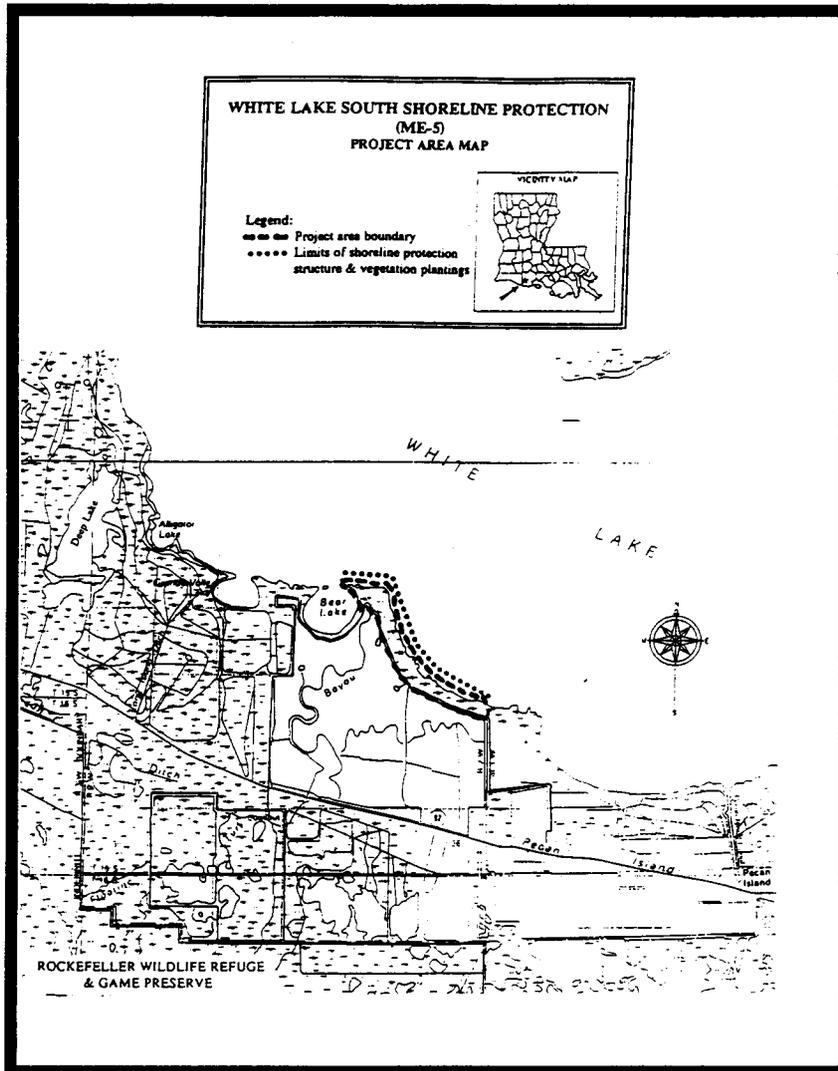


Figure 16. (ME-5) White Lake Shore Protection

## SUPPORTING SHORT TERM PROJECTS

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### ME-5/XME-38 SOUTH WHITE LAKE SHORE PROTECTION

#### Location

This project is located in the Lakes Sub-basin approximately 8 miles west-northwest of Pecan Island, Louisiana in Vermilion Parish (Figures 5 and 17), the project area includes a strip of approximately 1,358 acres of fresh and intermediate marsh along approximately 5.5 miles of the southern White Lake shoreline beginning just west of Grande Volle Lake and extending to about 1 mile southeast of Bear Lake, and also 2,030 acres of fresh marsh in an impoundment for use as cattle pasture.

#### Problems and Opportunities

The White Lake shoreline in the vicinity of Bear Lake has experienced erosion rates of 5.6 - 18.1 ft/yr. A narrow strip of marsh along the Bear Lake shoreline to the White Lake shoreline presently separates the lakes from an impoundment levee that protects a fresh marsh.

At present erosion rates, in 20 years most of the marsh between the Bear Lake shoreline and the management levee may be lost, increasing the likelihood of developing a breach in the adjacent impoundment levee, particularly during a major storm event. The marshes adjacent to Grande Volle Lake will be similarly impacted over time.

The objectives of this project are to halt shoreline erosion and protect the existing strip of marsh between the shoreline and the existing impoundment levee and adjacent to Bear Lake and Grande Volle Lake. This, in turn, will protect the impoundment levee. Also by breaking up the fetch, wave action from White Lake across Bear Lake and Grande Volle Lake will be reduced, which should promote the growth of submersed aquatic vegetation. The project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines.

#### Description of Features

Approx. 5.5 miles (29,000 ft) of segmented rock breakwater (250 feet long breakwaters with a 25 feet wide gap between each of them) will be installed in a staggered row at approx. the 2 feet contour line along the shoreline in the project area.

Suitable emergent marsh plant species will be planted along the edge of the shoreline for stabilization purposes. Approx. 6,400 plugs of emergent marsh plants of suitable species will be planted on five foot centers along the protected section of White Lake shoreline (approx. 27,804 linear feet) and the northern shorelines of Bear and Grand Volle lakes (approx. 5,000 linear feet) for stabilization purposes and to create emergent marsh. As many predator guards as plugs may be needed to prevent herbivory. [Comparison and evaluation of the success and suitability of several plant species for shoreline plantings may also be worked into the project design.]

#### Benefits and Costs

Wetland Value Assessment data indicate that this project will create 42 acres and protect 933 acres of marsh and create 304 acres of submerged aquatic vegetation. The cost of this project is estimated to be \$5,038,445.

**Effects and Issues**

This project will reverse shoreline erosion by promoting sediment deposition behind the breakwater. Vegetative plantings will create new habitat and stabilize the existing and newly created shorelines. Shoreline erosion will be reduced in Bear and Grand Volle Lakes. Wetland habitat will be preserved and restored thereby benefiting wetland dependent fish and wildlife populations. No adverse impacts are expected.

**Status**

The project was a candidate for the 1993 third priority list of the CWPPRA but was not selected. It may be a candidate for future priority lists.

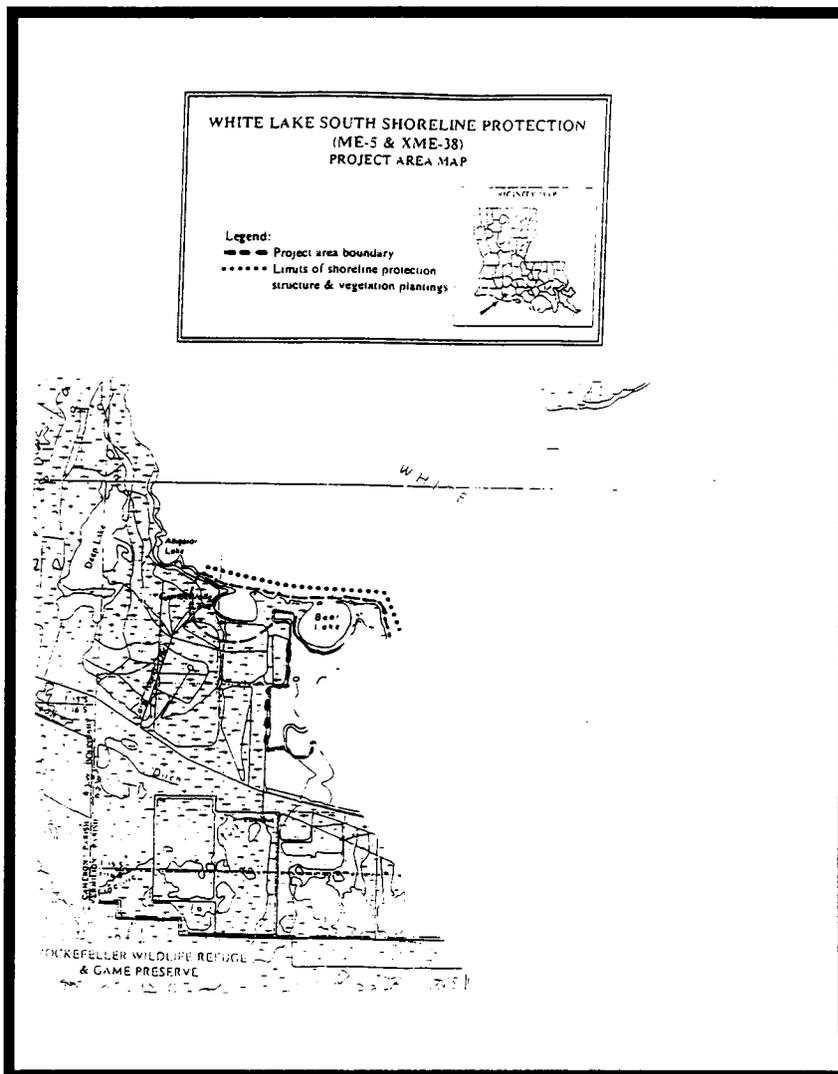


Figure 17. (ME-5/XME-8) South White Lake Shore Protection

### ME-6 BIG BURN MARSH CREATION AND PROTECTION

#### Location

Big Bum Marsh is located in the Lakes Sub-basin along the east side of LA Hwy. 27 just south of the Gulf Intracoastal Waterway (GIWW). The area selected for this demonstration terracing project located just north of an Arco Oil Co. facility and about 5 miles northeast of Creole, Louisiana in Cameron Parish (Figures 5 and 18). The 545 acre project area contains 41 acres of fresh marsh and 504 acres of shallow aquatic habitat.

#### Problems and Opportunities

As a result of an extensive marsh fire in the 1970's, much of the organic peat in Big Bum Marsh was burned off. This, combined with subsidence has lowered the elevation of the land surface considerably, so that today much of Big Bum Marsh consists of shallow, open water areas year-round at normal water levels. The objective of this project is to demonstrate the utility of terracing as a means of converting shallow, open water areas into emergent marsh and small, open water ponds with increased productivity of submersed aquatic vegetation, and greater value to wildlife and fisheries due to the increased land-water interface. Terracing will also protect adjacent marsh shorelines by reducing erosion due to wind-driven wave action. The project is compatible with the basin strategies of maintaining the geologic framework of the basin by controlling erosion of shorelines and treating critical areas of wetland loss within the interior of the basin.

#### Description of Features

Sediments excavated on-site will be used to construct approximately 18,650 feet of earthen terraces (with crown width of 2 feet and base width of 14 feet) to form eight square cells with open comers and 800 foot sides (700 feet of terrace and 50 feet of open space on each end) plus two rectangular cells 400 feet x 600 ft (each with sides comprised of 350 feet or 550 feet of terrace, respectively and 25 feet of open space on each end).

Approx. 7,460 plugs of emergent marsh plants of suitable species gathered from adjacent areas will be planted on five foot centers in a single row along each side of the terraces for stabilization and to create emergent marsh. As many predator guards as plugs will be needed to prevent herbivory.

#### Benefits and Costs

Wetland Value Assessment data indicate that this project will create 19 acres and protect 20 acres of marsh and create 101 acres of submerged aquatic vegetation. The cost of this project is estimated to be \$647,000.

#### Effects and Issues

This project will create emergent marsh where none presently exists. This will increase biological productivity and habitat suitability for area fish and wildlife. Terraces will reduce wind-induced shoreline erosion in the area. There is a possibility that the landowner may prefer to alter the design of this project to plant California bulrush *Scirpus californicus* in lieu of the terraces. No adverse impacts are anticipated.

**Status**

This project is presently listed in the State of Louisiana Coastal Wetlands Conservation and Restoration Program. This project still requires feasibility study. It may be a candidate for future priority lists.

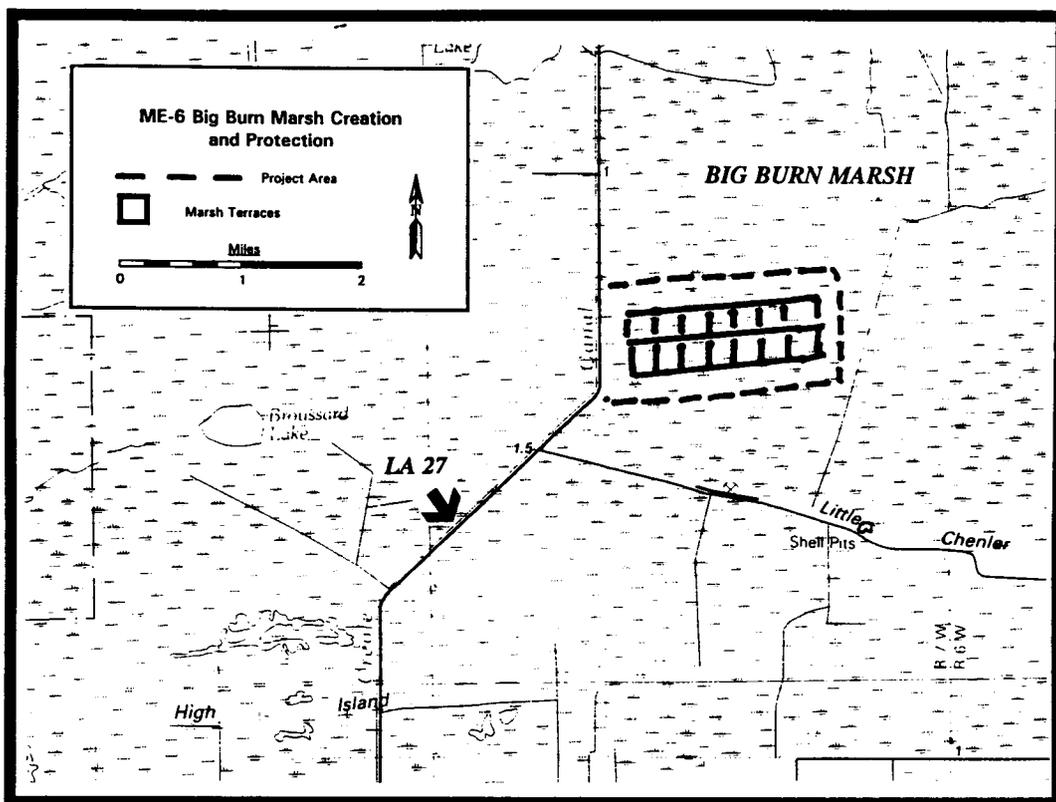


Figure 18. (ME-6) Big Burn Marsh Creation and Protection.

### ME-7 DEEP LAKE MARSH CREATION AND PROTECTION

#### Location

Deep Lake is located in the Lakes Sub-basin about 0.5 miles west-southwest of White Lake and about 10 miles west-northwest of Pecan Island, Louisiana on the Cameron and Vermilion Parish line (Figures 5 and 19). The 1,275 acre project area contains 284 acres of fresh to intermediate marsh and 736 acres of shallow aquatic habitat.

#### Problems and Opportunities

The impact of high winds and flood waters associated with Hurricane Audrey in 1957 resulted in the formation of many open water areas in the fresh Sawgrass marshes around Deep Lake. Construction of access canals subsequently subjected the area to tidal action and saltwater intrusion via the Superior Canal, which has led to the removal of bottom sediments from the shallow lake into the deeper access canal, and a loss of emergent fresh marsh and submerged aquatic vegetation. Tidal exchange has resulted in a shift from fresh to an intermediate marsh vegetation as far north in this area as the Old Intracoastal Waterway channel between White Lake and Grand Lake. Although the landowner plugged the access canal leading to the lake in 1992, the lake still has tidal connections to the Superior Canal through at least two trenasses. Deep Lake also now has about 2 miles of fetch from north to south and 1 mile from east to west, allowing wind-induced wave action to erode shorelines and increase turbidity in the water. The project objectives are to break up the fetch to reduce wave erosion along shorelines, to enhance aquatic plant growth by reducing turbidity, create and promote the development of emergent marsh on the terraces and adjacent shorelines, and to increase productivity and value to wildlife and fisheries by increasing the land-water interface. The project is compatible with the basin strategies of maintaining the geologic framework of the basin by controlling erosion of shorelines and treating critical areas of wetland loss within the interior of the basin.

#### Description of Features

Sediments excavated on-site will be used to construct approximately 3 1,000 feet of earthen terraces (crown width of 5 feet, slope of 4: 1) to form ten 1,000 foot square cells with open corners (each side with 900 feet of terrace and 50 feet of open space on each end). [Comparison and evaluation of the effects of varying cell size, orientation, and arrangement may be worked into the final design. This may involve different terrace widths.]

Approx. 12,400 plugs of emergent marsh plants of suitable species gathered from adjacent areas will be planted on five foot centers in a single row along each side of the terraces for stabilization and to create emergent marsh. As many predator guards as plugs will be needed to prevent herbivory. [Comparison and evaluation of the success and suitability of several plant species may be worked into the design, e.g., comparison of California bullwhip (*Scirpus californicus*)\_ and Soft stem bulrush (*S. validus*).]

**Effects and Issues**

This project will create emergent marsh where none presently exists. This will increase biological productivity and habitat suitability for area fish and wildlife. Terraces will reduce wind-induced shoreline erosion in the area. There is a possibility that the landowner may prefer to alter the design of this project to plant California bulrush *Scirpus californicus* in lieu of the terraces. No adverse impacts are anticipated.

**Status**

This project is presently listed in the State of Louisiana Coastal Wetlands Conservation and Restoration Program. This project still requires feasibility study and may be a candidate for future priority lists.

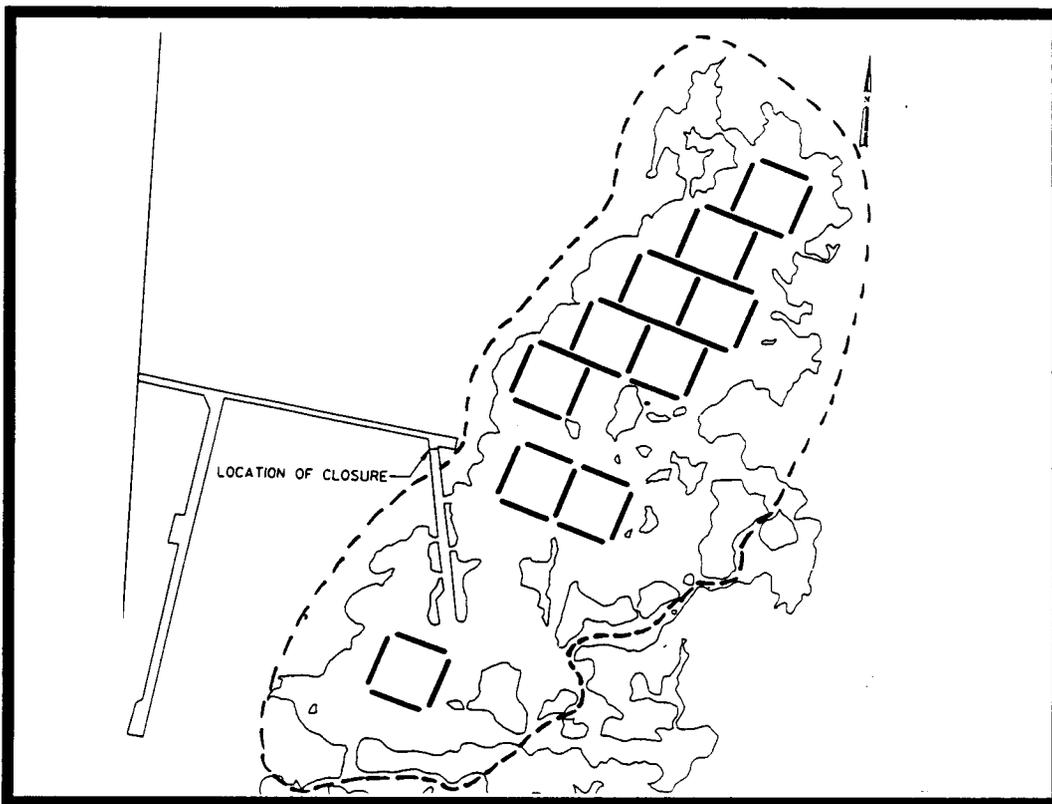


Figure 19. (ME-7) Deep Lake Marsh Creation and Protection.

## SUPPORTING SHORT TERM PROJECTS

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### PME-1 GIWW BANK PROTECTION

#### Location

This project is located in the Lakes Sub-basin on the south bank of the Gulf Intracoastal Waterway between the Vermilion/Cameron Parish boundary and the Florence Canal in Vermilion Parish, Louisiana (Figures 5 and 20). The project area encompasses 178 acres of fresh marsh habitat.

#### Problems and Opportunities

Severe shoreline erosion has breached the south bank of the GIWW allowing saltwater intrusion into adjacent wetlands threatening the loss of fresh marsh habitat. The deep water channel along this reach is very near to the existing south bank and the much of the spoil bank in this area is comprised of highly erodible soils and has already breached in some locations. Shoreline stabilization using rip-rap placed the bank will halt erosion and preserve habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

#### Description of Features

This project calls for placement of rip-rap placed along 7 miles of GIWW shoreline on the south bank between the Vermilion and Cameron Parish boundary and the Florence Canal.

#### Benefits and Costs

Rapid assessment WVA protocol indicates that the project is expected to create 51 acres of marsh and protect 127 acres at an estimated cost of \$3,160,000.

#### Effects and Issues

This project will halt erosion along this section of shoreline thereby creating and preserving valuable fresh marsh habitat for the benefit of wetland dependent fish and wildlife populations. There appears to be some overlap between this project and (XME-44) GIWW Bank Stabilization Vermilion/Cameron Parish Boundary. No adverse impacts are expected from this project.

#### Status

This project is conceptual and requires study to determine feasibility and the overall effectiveness of using rip-rap for bank stabilization or if another form of stabilization would be more suitable and cost effective. It may be a candidate for future priority lists.



## SUPPORTING SHORT TERM PROJECTS

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### PME-2 ROCKEFELLER GULF SHORELINE

#### Location

This project is located in the Chenier Sub-basin on the Gulf of Mexico shore along the westernmost nine miles of shoreline on the Rockefeller State Wildlife Refuge in Cameron Parish, Louisiana (Figures 5 and 2 1). The project area encompasses 1,635 acres of brackish marsh habitat.

#### Problems and Opportunities

Severe shoreline erosion (30-55 ft/yr) on the gulf shore in this area threatens the integrity of the Rockefeller refuge Price Management Unit. The Price Management Unit is a passively managed low salinity brackish marsh that is threatened by shoreline erosion at its western end. If the management levee is breached, the 7,500 acre management unit will be exposed to more saline conditions and increased tidal fluctuation that will result in habitat loss and modification. Shoreline stabilization will reverse erosion and preserve habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

#### Description of Features

This project features calls for the construction of nine miles of rock breakwaters of similar design as are currently installed from Ocean View Beach to Peveto Beach. Breakwaters are 150' in length, 10' wide at the crown, with 3: 1 side slopes. Breakwaters will be placed 300 to 500' offshore in 4-6 feet of water on 300' centers.

#### Benefits and Costs

This project should halt erosion and build land along this section of beach thereby preventing the breaching of the shoreline into the back chenier marsh. This project will create and protect 850 acres and enhance 63 acres for a total benefit of 913 acres at an estimated cost of \$9,000,000.

#### Effects and Issues

The project should reverse erosion and protect brackish marsh habitat. At the same time, rock breakwaters will foster fishing in the area. No adverse impacts are expected nor are there any key issues known at the time of this writing.

#### Status

This project is conceptual and requires feasibility study. It may be a candidate for future priority lists.

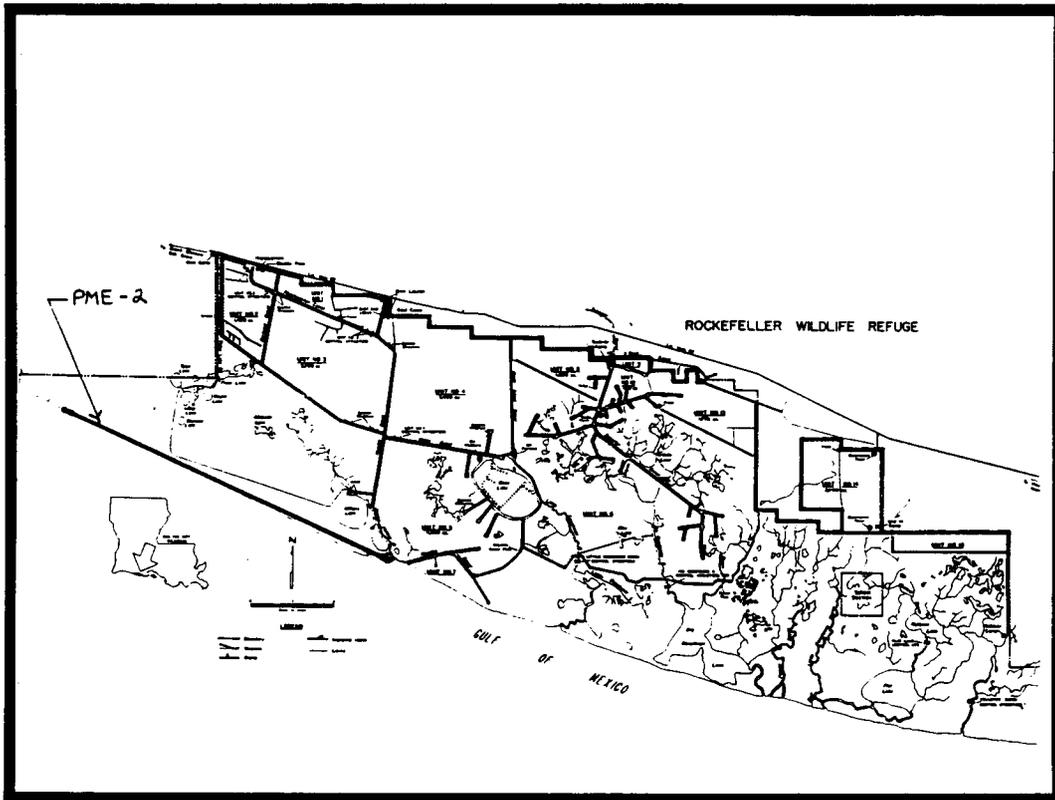


Figure 21. (PME-2) Rockefeller Gulf Shoreline.

## SUPPORTING SHORT TERM PROJECTS

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### PME-3 OLD GIWW SHORE PROTECTION

#### Location

This project is located in the Lakes Sub-basin on the Old GIWW between Grand and White Lakes in Cameron and Vermilion Parishes respectively (Figure 5 and 22). Acreage of this project area has not been determined.

#### Problems and Opportunities

The shoreline of the Old GIWW between Grand and White Lakes is rapidly eroding, increasing the size of the hydrologic link between Grand and White Lakes. There is great concern that if shoreline erosion in this region are not halted, there is potential that the two lakes may eventually coalesce into a single water body. Wave dampening/sediment fencing along the shoreline will reduce boat wake erosion and potentially build new land along the shoreline. This project is defensive in nature and is compatible with the basin strategy of controlling shoreline erosion in navigation channels.

#### Description of Features

This project consists of 4 miles of wave damping fence and vegetative plantings.

#### Benefits and Costs

This project is expected to protect 20 acres of intermediate marsh at a cost of \$750,000.

#### Effects and Issues

This project will protect the shoreline along the Old GIWW and vegetative planting will increase biological productivity in the area. No adverse impacts are expected from the project.

#### Status

This project is still in the conceptual phase and a feasibility study is needed. The project may be a candidate for future priority lists.

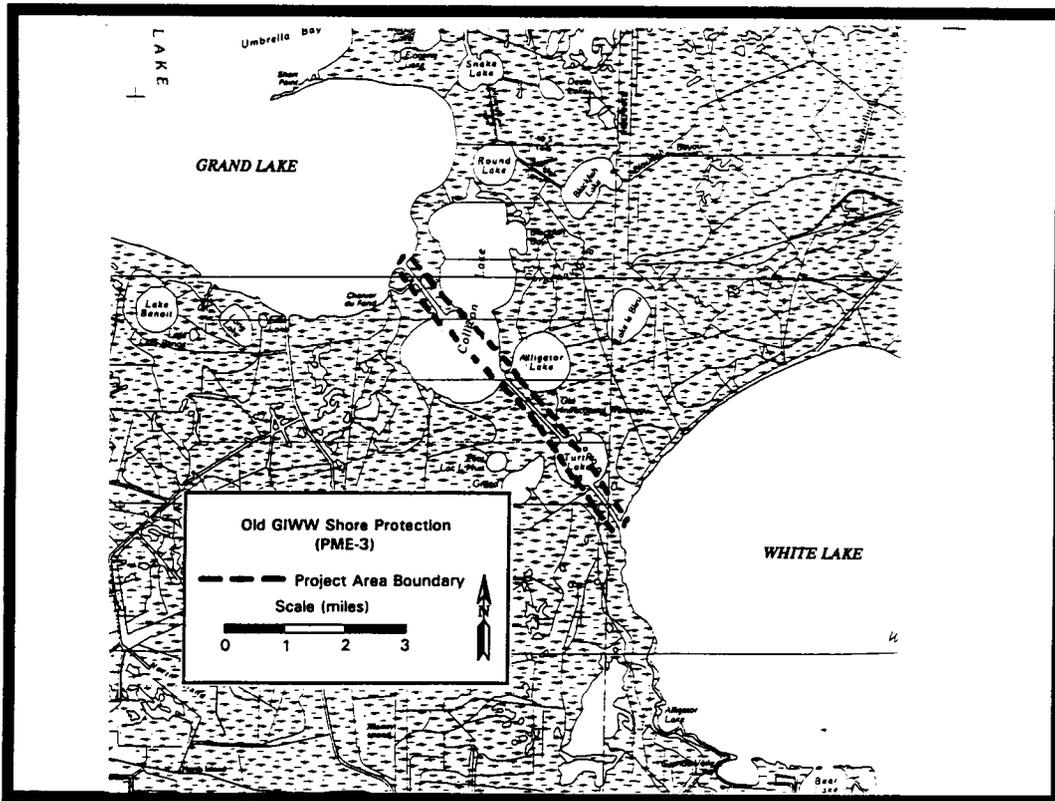


Figure 22. (PME-3) Old GIWW Shore Protection

## SUPPORTING SHORT TERM PROJECTS

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### PME-5 GRAND LAKE SOUTH SHORE

#### Location

This project is located in the Lakes Sub-basin on the south shore of Grand Lake in Cameron Parish Louisiana (Figures 5 and 23). The project area comprises approximately 86 acres of fresh marsh.

#### Problems and Opportunities

This area has is suffering from excessive (30-50 ft/yr) shoreline erosion due to artificially elevated water levels in the Lakes Sub-basin. This threatens fragile marshes adjacent to the lake rim. There is an opportunity to reduce shoreline erosion along this shore by stabilizing the lake shore rim.

#### Description of Features

This project calls for stabilization of the south Grand Lake shore by installing rip-rap along 10,000 linear feet of shoreline north of Long and East Lakes.

#### Benefits and Costs

This project should halt erosion along this section of lake shore thereby preventing the breaching of the shoreline of Long Lake and East Lake. This project is expected to protect 74 acres of fresh marsh and aquatic vegetation is expected to increase in cover by 12 acres for a total benefited acreage of 86 acres. The project cost is estimated at \$980,000.

#### Effects and Issues

The project should reduce erosion and protect fragile fresh marsh habitat. No adverse impacts are expected nor are there any key issues known at the time of this writing.

#### Status

This project is conceptual and requires feasibility study. It may be a candidate for future priority lists.

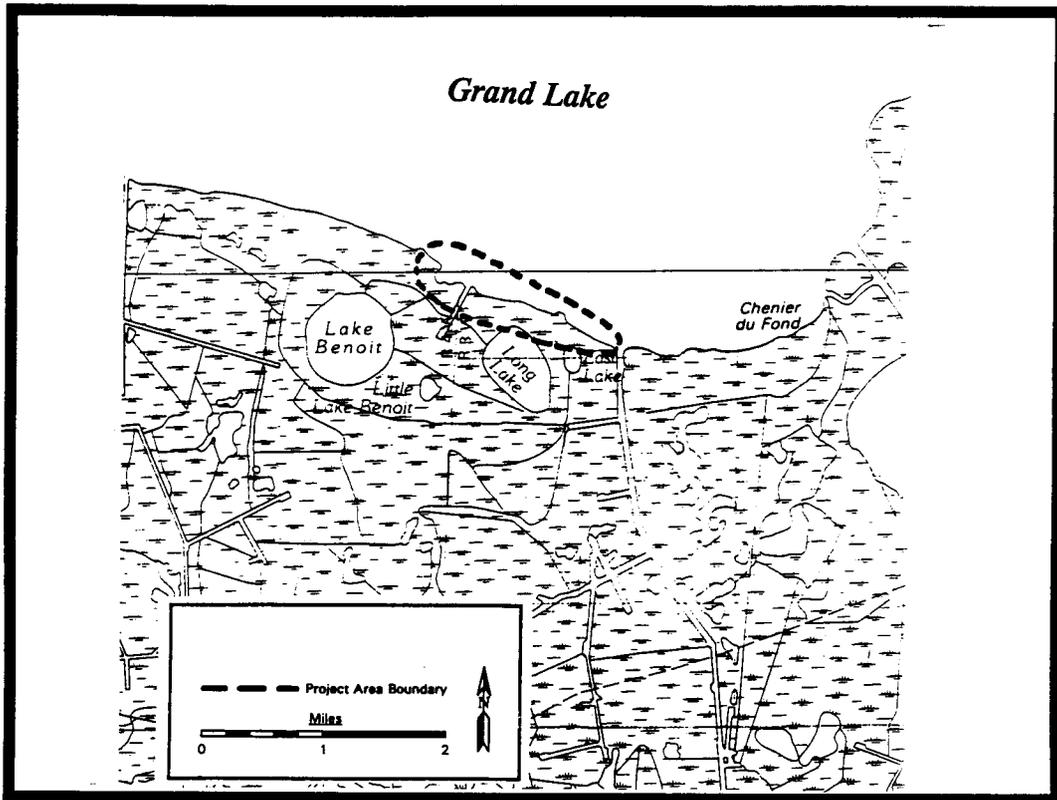


Figure 23. (PME-5) Grand Lake South Shore.

## SUPPORTING SHORT TERM PROJECTS

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### PME-6 SOUTHWEST WHITE LAKE SHORE PROTECTION

#### Location

This project is located in the Lakes Sub-basin on the southwest shore of White Lake in Vermilion Parish Louisiana (Figures 5 and 24). The project area comprises one mile of shoreline between Alligator Lake and the Old Intracoastal Waterway and encompasses approximately 25 acres of fresh marsh.

#### Problems and Opportunities

This area has is suffering from 10 ft/yr shoreline erosion due to artificially elevated water levels in the Lakes Sub-basin. Shoreline protection is needed to prevent White Lake from breaching into 1800 acres of shallow open water known as Deep Lake. If breaching occurs there will be severe interior erosion of the Deep Lake marsh. This project will determine if California bulrush *Scirpus californicus* is effective in dampening high wave energies. The project fits in with the basin strategy of controlling shoreline erosion.

#### Description of Features

Three rows of California bulrush will be planted in 0-1.5 ft. of water along a one mile stretch of shoreline beginning at the northern end of Alligator Lake and continuing north.

#### Benefits and Costs

This project should reduce erosion along this section of lake shore thereby preventing the breaching of the shoreline into the Deep Lake marsh. This project will create and protect **16** acres of fresh marsh as well as enhance 3 acres of aquatic vegetation for a total benefit of 18 acres at an estimated cost of \$92,000. Total benefited acreage is estimated to be 44 acres.

#### Effects and Issues

The project should reduce erosion and protect fragile fresh marsh habitat. No adverse impacts are expected nor are there any key issues known at the time of this writing.

#### Status

This project is a demonstration project and was funded on the 1993 CWPPRA third priority list. Construction is expected to begin by early 1995.

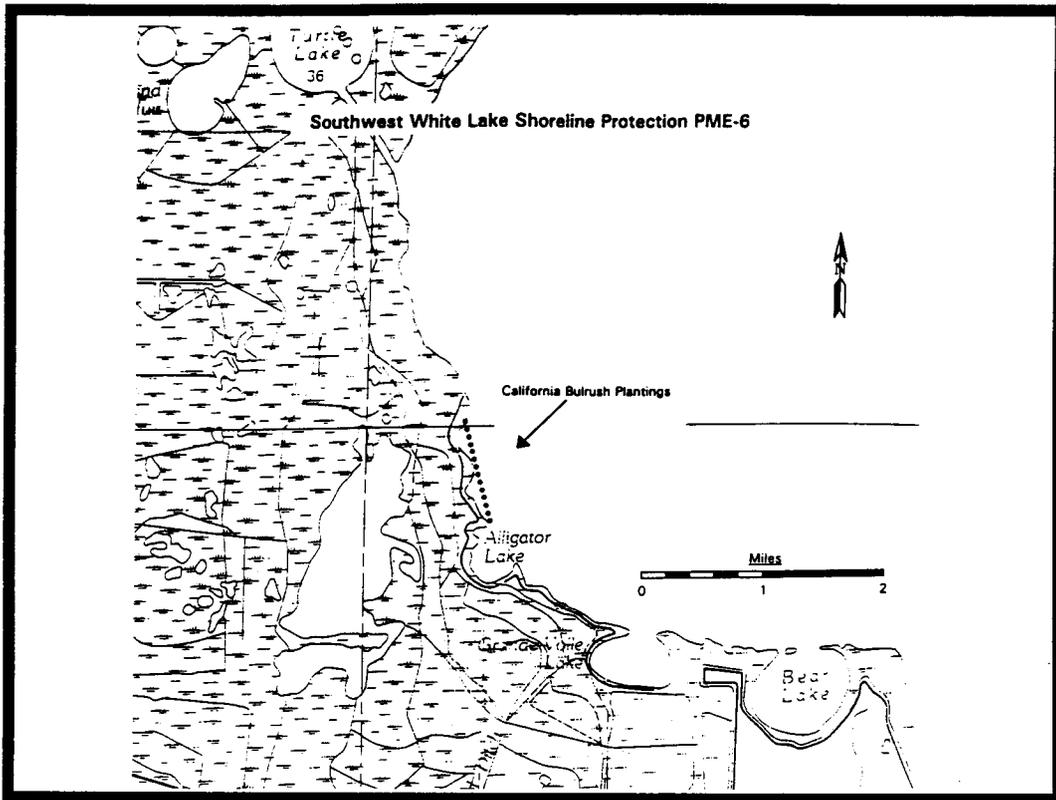


Figure 24. (PME-6) Southwest White Lake Shore Protection

## SUPPORTING SHORT TERM PROJECTS

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### PME-9 MERMENTAU RIVER TO ROCKEFELLER SHORE PROTECTION

#### Location

This project is located in the Chenier Sub-basin on the Gulf of Mexico shoreline south of Lower Mud Lake in Cameron Parish Louisiana (Figures 5 and 25). The project area comprises two miles of shoreline and encompasses approximately 812 acres of saline marsh habitat.

#### Problems and Opportunities

This area has is suffering from 30-60 ft/yr shoreline erosion caused by wave erosion from the Gulf of Mexico. The last remaining chenier ridge is eroding badly and if it breaches, approximately 800 acre of saline marsh will suffer accelerated land loss. Segmented rock breakwaters have shown promise in halting erosion and rebuilding beaches west of the project area in at Oceanview and Peveto beaches. The objective of this project is to reverse erosion and protect the saline marsh landward of the breakwaters from direct wave attack from the Gulf of Mexico. The project fits in with the basin strategy of controlling erosion of the Gulf of Mexico shoreline.

#### Description of Features

The only project features in this area call for the construction of two miles of rock breakwaters of similar design as are currently installed from Ocean View to Peveto Beach. Breakwaters are 150' in length, 10' wide at the crown, with 3: 1 side slopes. Breakwaters will be placed 300 to 500' offshore in 4-6 feet of water on 300' centers.

#### Benefits and Costs

This project should halt erosion and build land along this section of beach thereby preventing the breaching of the shoreline into the back chenier marsh. This project will create 36 acres, protect 382 acres and enhance 32 acres of beach and saline marsh at an estimated cost of \$4,200,000. Total benefited acreage is estimated to be 450 acres.

#### Effects and Issues

The project should reverse erosion and protect saline marsh habitat. At the same time, rock breakwaters will foster fishing in the area. No adverse impacts are expected nor are there any key issues known at the time of this writing.

#### Status

This project is conceptual and requires feasibility study. It may be a candidate for future priority lists.

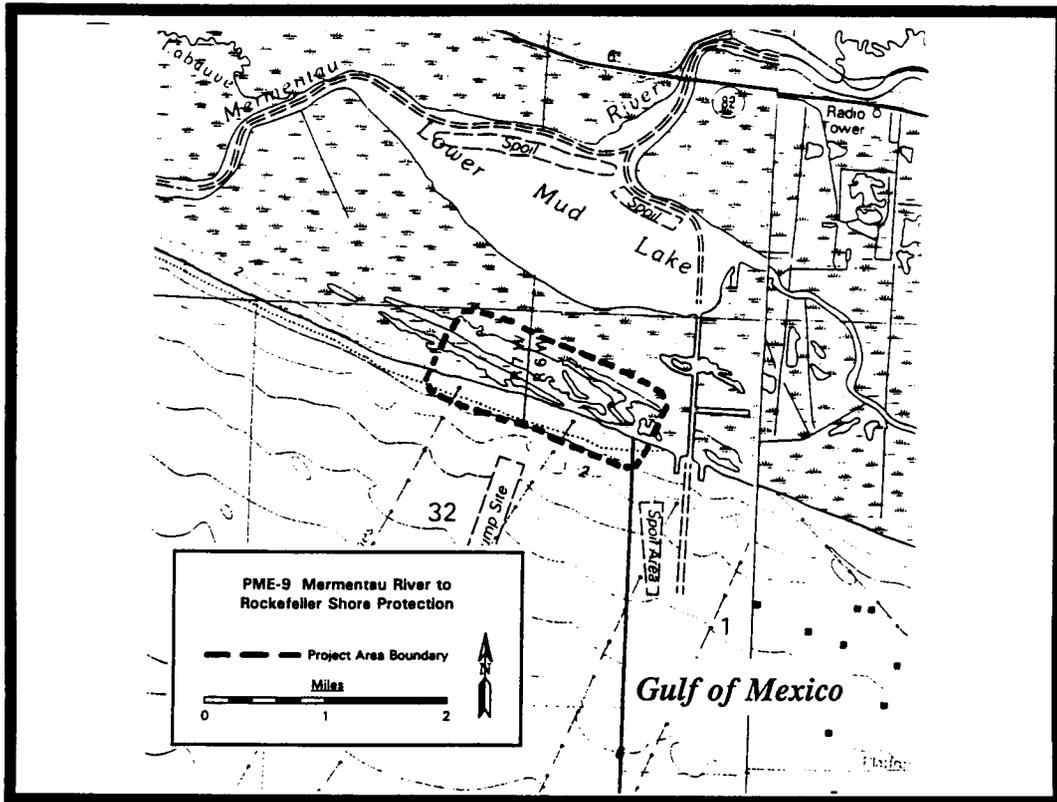


Figure 25. (PME-9) Mermentau River to Rockefeller Shore Protection

## SUPPORTING SHORT TERM PROJECTS

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### PME-14 SAWMILL CANAL STRUCTURE

#### Location

This project area is located in the Lakes Sub-basin off of Little Pecan Bayou approximated 4 miles east of Upper Mud Lake and 2 miles west of Little Pecan Lake in Cameron Parish, Louisiana (Figures 5 and 26). This area encompasses 3,000 acres of fresh marsh, intermediate marsh, a small bald cypress stand, and shallow open water habitat.

#### Problems and Opportunities

This project area contains diverse freshwater wetlands that are maintained by controlling saltwater intrusion and management of water levels through a number of control structures and a levee along the Little Pecan Bayou and Sawmill Canal. A number of these structures are failing and would be replaced by a single structure across Sawmill Canal at Little Pecan Bayou and levee repairs along the bayou. This would eliminate the need to replace several structures and maintain management capabilities in this wetland. This project is compatible with the overall basin strategies of treating critical areas of wetland loss within the interior of the basin and managing water levels with structures in the Lakes Sub-basin to relieve stress on interior wetlands.

#### Description of Features

Four (4) 48 inch flapgated culverts with an 8 foot variable crest weir will be installed on Sawmill Canal at Little Pecan Bayou. In addition, approximately 10,560 feet of levee repairs will be done along Little Pecan Bayou.

#### Benefits and Costs

These project features will allow continued water management in this marsh that will sustain biological productivity for resident fisheries and wildlife. Rapid protocol Wetland Value Assessment data indicate that the project is expected to protect 229 acres of marsh and enhance 257 acres of marsh and aquatic vegetation for a total benefit of 486 acres at an estimated cost of \$1,100,000.

#### Effects and Issues

Approximately 1,050 acres of freshwater wetland habitat will be protected by this project, however levees and water control structures will somewhat limit ingress and egress of estuarine fisheries although some resident fisheries will likely benefit from the project.

#### Status

This project still requires feasibility study and was a candidate for the CWPPRA 1992 priority list but was not selected for funding. It may be a candidate for future priority lists.

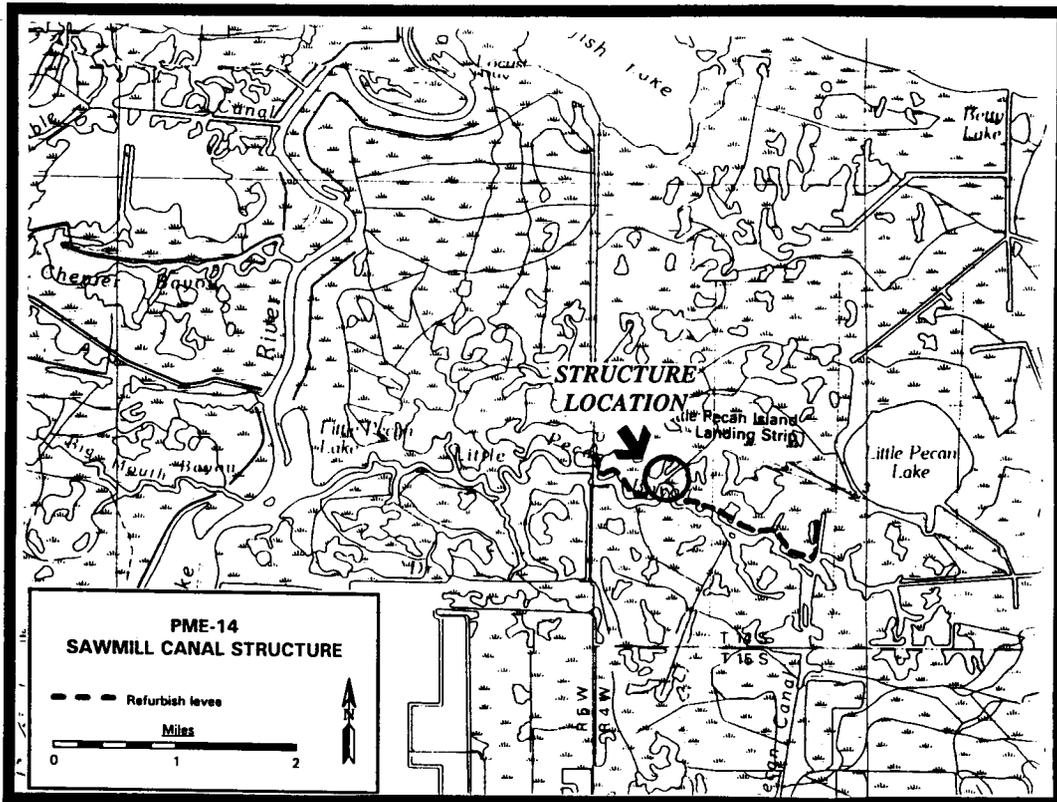


Figure 26. (PME-14) Sawmill Canal Structure.

## SUPPORTING SHORT TERM PROJECTS

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### PME-15 HUMBLE CANAL STRUCTURE

#### Location

This project area is located in the Lakes Sub-basin on the Mermentau River approximately 2 miles southwest of Grand Lake at the Humble Canal in Cameron Parish, Louisiana (Figures 5 and 27). This area encompasses 5,500 acres of fresh and intermediate marsh habitat.

#### Problems and Opportunities

This Grand and White Lakes system has been maintained as a fresh marsh environment for several decades with limited loss of wetlands. This has been accomplished through water management involving a hydrologic boundary composed of natural ridges, levees, locks, and other water control structures. One of these structures, the Humble Canal structure has fallen into disrepair. The project would involve replacing the existing structure. This project is compatible with the overall basin strategies of treating critical areas of wetland loss within the interior of the basin and managing water levels with structures in the Lakes Sub-basin to relieve stress on interior wetlands.

#### Description of Features

Install five 48-inch flapgated culverts and an 8 foot variable crest weir on the Humble Canal at Mermentau River.

#### Benefits and Costs

These project features will allow continued water control between the Mermentau River and Humble Canal to will sustain biological productivity for resident fisheries and wildlife. Rapid protocol Wetland Value Assessment data indicate that the project is expected to protect 1,392 acres of marsh and enhance 642 acres of marsh and aquatic vegetation. The project has an overall benefit of 2,034 acres at an estimated cost of \$700,000.

#### Effects and Issues

Approximately 1,050 acres of freshwater wetland habitat will be protected by this project, however levees and water control structures will somewhat limit ingress and egress of estuarine fisheries although some resident fisheries will likely benefit from the project.

#### Status

This project still requires feasibility study and was a candidate for the CWPPRA 1992 priority list but was not selected for finding. It may be a candidate for future priority lists.

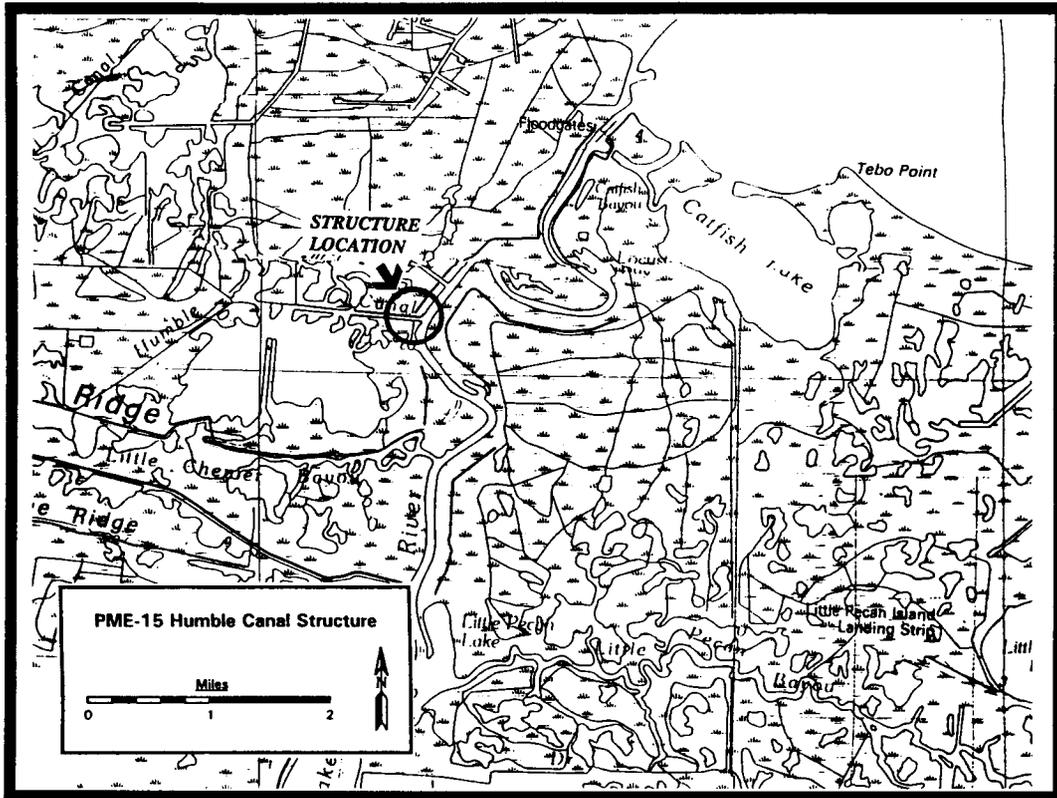


Figure 27. (PME-15) Humble Canal Structure.

## SUPPORTING SHORT TERM PROJECTS

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### XME-17 NORTH CANAL TO MERMENTAU RIVER

#### Location

This project area is located in the Lakes Sub-basin on the north bank of the Gulf Intracoastal Waterway between North Canal the Mermentau River in Cameron Parish, Louisiana (Figures 5 and 28). This area encompasses 14 linear miles of spoil levee on that protects fresh marsh north of the GIWW.

#### Problems and Opportunities

Severe erosion along this stretch of the GIWW is resulting in loss of marsh in adjacent freshwater wetlands and significant losses of more marsh is imminent. Shoreline stabilization along the length of the shoreline or at strategic locations where breaching has occurred, or will occur in the near future, will prevent this loss of habitat. This project is compatible with the basin strategy of controlling erosion of shorelines and navigation channels.

#### Description of Features

Rip-rap shoreline armor will be installed along the north bank of the GIWW between North Canal and the Mermentau River.

#### Benefits and Costs

Shoreline stabilization will halt erosion and slow the loss of fresh marshes north of the GIWW in this area. The project is expected to protect 221 acres and enhance 20 acres of fresh marsh and aquatic vegetation. The project has an overall benefit of 241 acres at an estimated cost of \$6,300,000.

#### Effects and Issues

This project will halt erosion and protect freshwater wetland habitat. No adverse impacts are anticipated at the present. It may be more feasible to limit placement of rip-rap to areas that have already breached or are in imminent danger of doing so. Alternative means of shoreline stabilization need to be addressed.

#### Status

This project is conceptual and requires feasibility study. It may be a candidate for future priority lists.

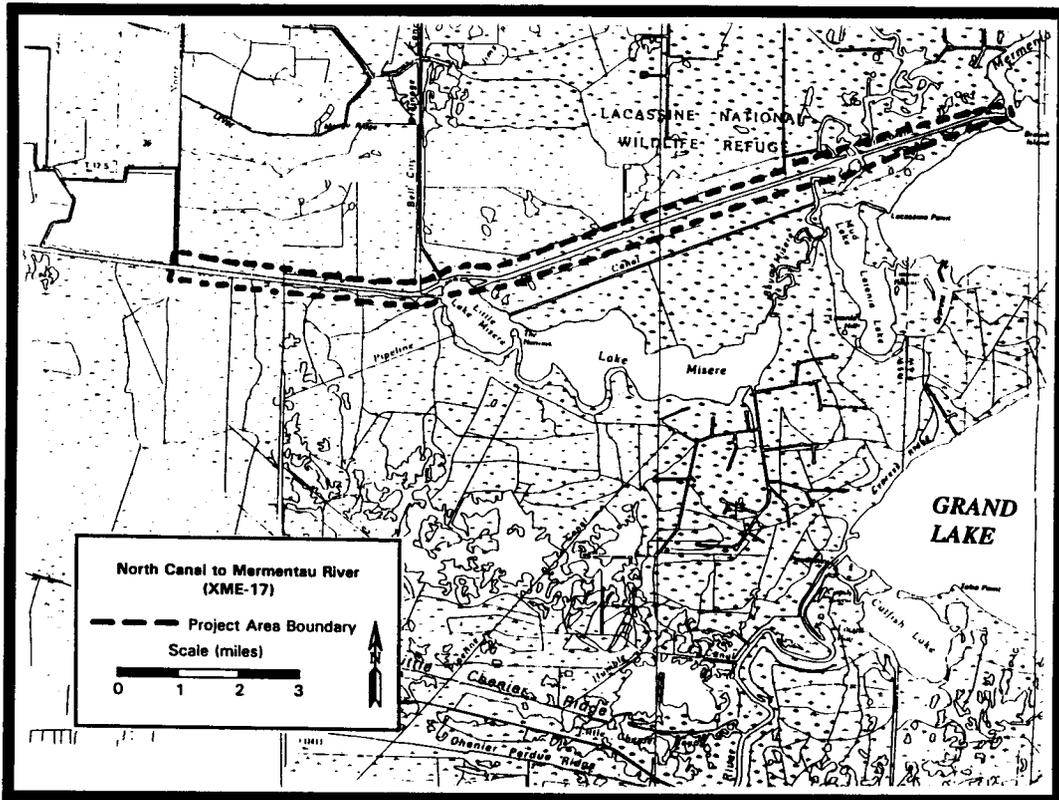


Figure 28. (XME-17) North Canal to Mermentau River.

## SUPPORTING SHORT TERM PROJECTS

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### XME-18 LAKE SHORE RIMS

#### Location

This project area is located in the Lakes Sub-basin on the south shore of White Lake north of Pecan Island in Vermilion Parish, Louisiana (Figures 5 and 29). This area encompasses 20,000 linear feet of lake shore that protects fresh/intermediate marsh.

#### Problems and Opportunities

The shoreline of White Lake is eroding at a rate of 3-6 ft/yr. and over time, the original lake rim has been lost to erosion. There is an opportunity to restore the original lake rim through the use of dedicated dredging of White Lake sediments. This coupled with vegetative plantings could recreate the historic lake rim and protect marshes north of Pecan Island. This project is compatible with the basin strategy of controlling erosion of shorelines and navigation channels.

#### Description of Features

An undetermined amount of White Lake sediment would be excavated by hydraulic dredge and deposited on the south shore of White Lake north of Pecan Island. 20,000 feet of historic lake rim will be recreated. Appropriate stabilizing vegetation will be planted after the dredged material settles.

#### Benefits and Costs

Shoreline stabilization will slow erosion and recreate the historic lake rim in this area. The project is expected to protect 92 acres of fresh marsh at an estimated cost of \$370,000.

#### Effects and Issues

This project will slow erosion and protect freshwater wetland habitat. No adverse impacts are anticipated at the present. Alternative means of shoreline stabilization may need to be addressed.

#### Status

This demonstration project is conceptual and requires feasibility study. It may be a candidate for future priority lists.

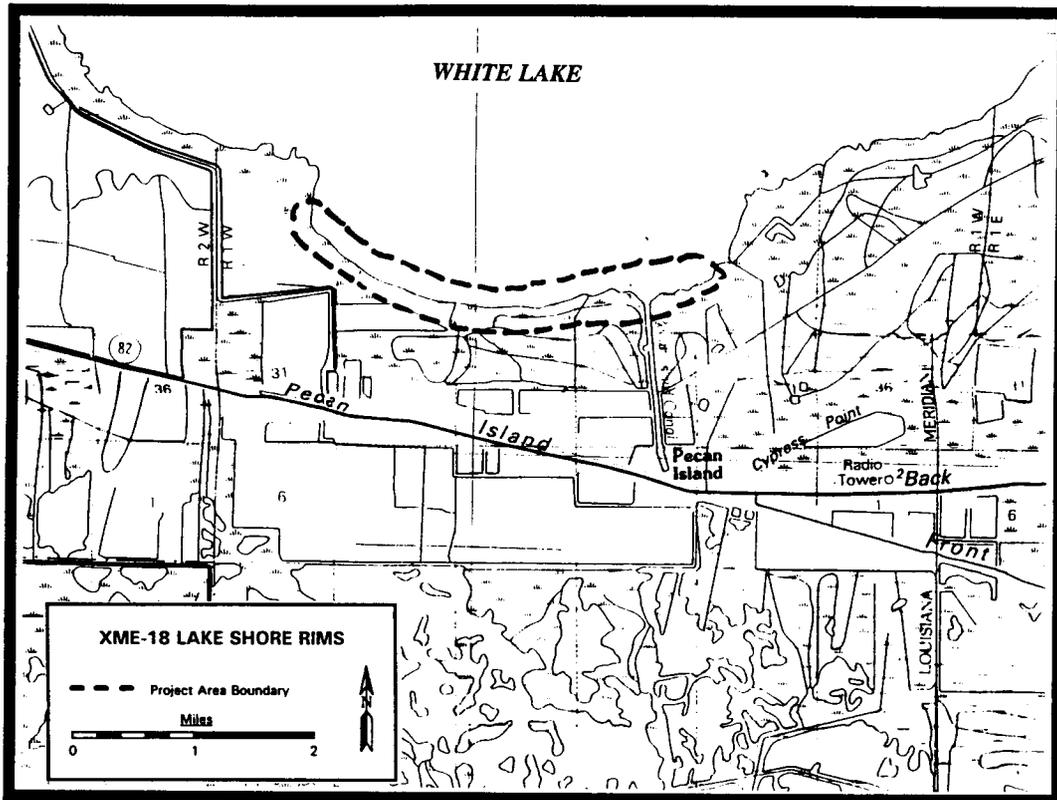


Figure 29. (XME-18) Lake Shore Rims.

## SUPPORTING SHORT TERM PROJECTS

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### XME-22 PECAN ISLAND TERRACING

#### Location

This project area is located in the Chenier Sub-basin in a former agricultural impoundment south of Little Pecan Island and LA 82 in Vermilion Parish, Louisiana (Figures 5 and 30). This area encompasses 1,830 acres of shallow open water.

#### Problems and Opportunities

Historically, thousands of acres of wetlands in coastal Louisiana were impounded and reclaimed for agricultural purposes. Over time, many of these impoundments failed resulting in shallow ponds with little use for agriculture or wetland dependent wildlife and fish. This is the case with this project area. Dredging shallow water bottoms for the creation of marsh terraces has been shown to be very effective in creating new wetland habitat in areas of shallow water bottoms with relatively high sediment mineral content. This project will create wetland habitat, improve the fish and wildlife productivity of the area by building marsh terraces, and reduce wind-induced erosion of shorelines. This project is compatible with the basin strategy of treating critical areas of wetlands loss within the interior of the basin.

#### Description of Features

Approximately 240,000 cubic yards of material will be used to construct terrace ridges in the impoundment. The proposal calls for two wide terraces with a toe to toe width of 60 feet. Four smaller terraces with toe to toe widths of 15 feet will be constructed landward of the wide terraces. In the eastern part of the project area, three additional narrow ridges will be constructed. The terraces will be constructed in a rectangular pattern with the long sides in an east to west orientation. The total length of the ridges will be approximately 10.4 miles.

#### Benefits and Costs

Rapid protocol Wetland Value Assessment data indicate that the project is expected to create and protect 23 acres of brackish marsh and enhance 984 acres of submerged aquatic vegetation. The project has an overall benefit of 1,017 acres at an estimated cost of \$1,700,000.

#### Effects and Issues

This project will create wetland habitat where none presently exists. This will increase biological productivity and habitat suitability for area fish and wildlife. Terraces will reduce wind-induced shoreline erosion in the area. No adverse impacts are anticipated.

#### Status

This project was a candidate for the 1993 CWPPRA 3rd priority list but was not selected for funding. It may be a candidate for future priority lists.

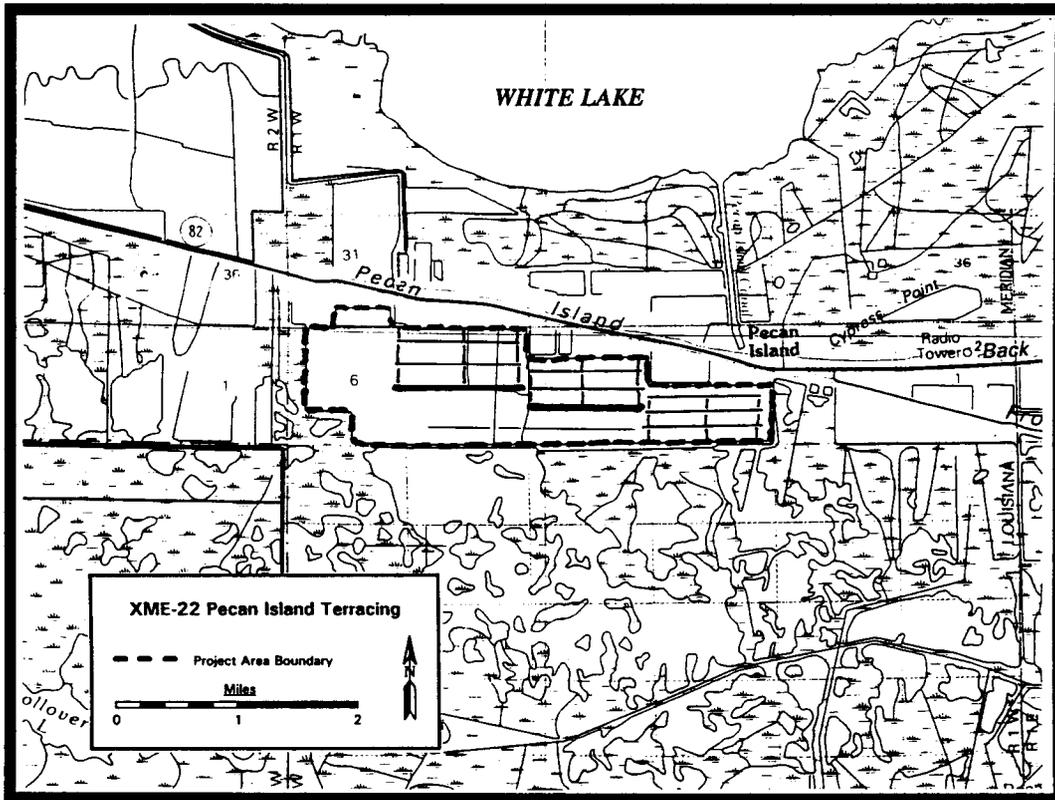


Figure 30. (XME-22) Pecan Island Terracing.

## SUPPORTING SHORT TERM PROJECTS

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### XME-26 WARREN CANAL STRUCTURE

#### Location

This project area is located in the Lakes Sub-basin north of White Lake at the intersection of the Gulf Intracoastal Waterway and Warren Canal in Vermilion Parish, Louisiana (Figures 5 and 3 1). The acreage benefited by this project have not be determined.

#### Problems and Opportunities

As the basin strategy of lowering water levels in the Lakes Sub-basin is implemented, the Warren Canal could become a greater avenue for saltwater intrusion from the GIWW. This would adversely impact fresh marshes in the sub-basin and possibly agricultural activities to the north. This project calls for installing a channel constriction structure on the Warren Canal immediately north of its intersection with the GIWW. A structure at this location would allow for increased opening of the Schooner Bayou Lock which would, in turn, allow for increased ingress and egress of fish into White Lake thereby increasing the lakes productivity without adversely impacting wetlands and agriculture north of the GIWW. This project is neither compatible nor incompatible with the basin strategies.

#### Description of Features

This project calls for a weir with a boat by on Warren Canal immediately north of its intersection with the GIWW.

#### Benefits and Costs

The benefits of this project have not been determined but the cost of such a structure is estimated at \$150,000.

#### Effects and Issues

This project should reduce saltwater intrusion north of the GIWW while allowing for increased operation of the Schooner Bayou Locks which will, in turn, increase fishery productivity in White Lake without impacting agriculture north of the GIWW. However, a structure would somewhat reduce ingress and egress of estuarine fisheries north of the structure. Marsh acreage benefits are unavailable at the time of this writing.

#### Status

This project is conceptual and requires study to determine feasibility and benefits as well as potential adverse impacts. It may be a candidate for future priority lists.

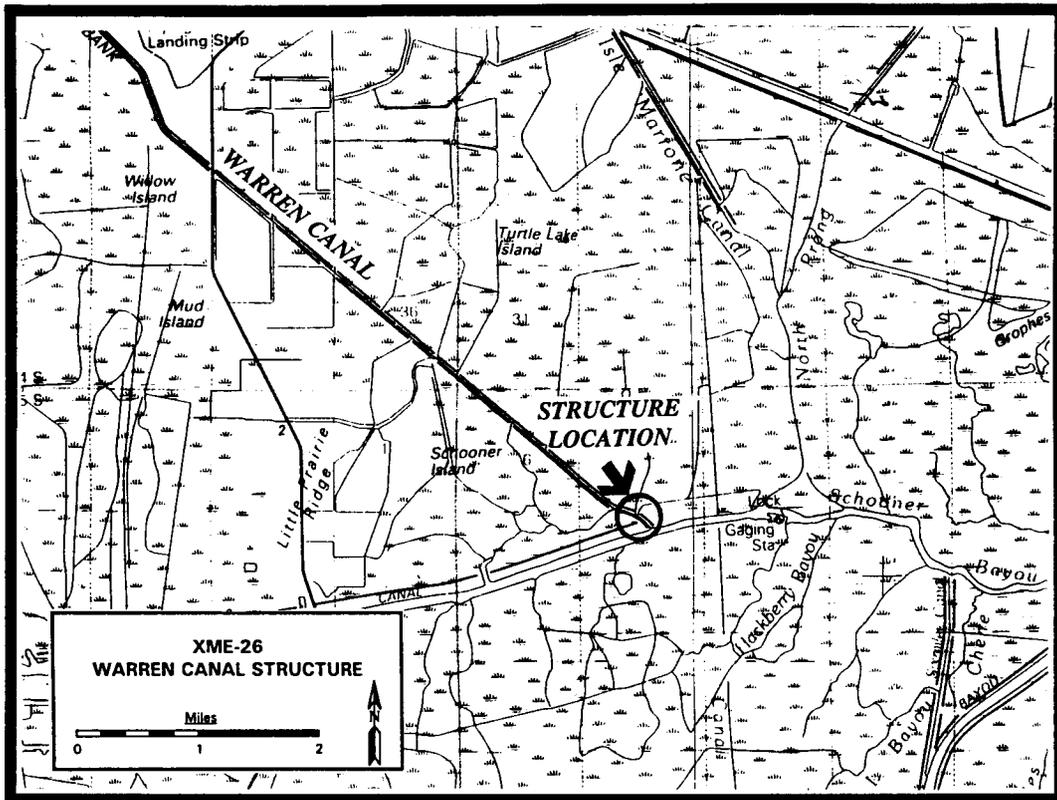


Figure 31. (XME-26) Warren Canal Structure.

## SUPPORTING SHORT TERM PROJECTS

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### XME-27 SEVENTH WARD CANAL STRUCTURE

#### Location

This project area is located in the Lakes Sub-basin five miles west of Intracoastal City at the intersection of the Gulf Intracoastal Waterway and the Seventh Ward Canal in Vermilion Parish, Louisiana (Figures 5 and 32). The acreage benefited by this project have not be determined.

#### Problems and Opportunities

As the basin strategy of lowering water levels in the Lakes Sub-basin is implemented, the Seventh Ward Canal could become a greater avenue for saltwater intrusion from the GIWW. This would adversely impact fresh marshes in the sub-basin and possibly agricultural activities to the north. This project calls for installing a channel constriction structure on the Seventh Ward Canal immediately north of its intersection with the GIWW. A structure at this location would allow for increased opening of the Schooner Bayou Lock which would in turn allow for increased ingress and egress of fish into White Lake thereby increasing the lakes productivity without adversely impacting wetlands and agriculture north of the GIWW. This project is neither compatible nor incompatible with the basin strategies.

#### Description of Features

This project calls for a weir with a boat by on Seventh Ward Canal immediately north of its intersection with the GIWW.

#### Benefits and Costs

The benefits of this project have not been determined but the cost of such a structure is estimated at \$150,000.

#### Effects and Issues

This project should reduce saltwater intrusion north of the GIWW while allowing for increased operation of the Schooner Bayou Locks which will, in turn, increase fishery productivity in White Lake without impacting agriculture north of the GIWW. However, a structure would somewhat reduce ingress and egress of estuarine fisheries north of the structure. Marsh acreage benefits are unavailable at the time of this writing.

#### Status

This project is conceptual and requires study to determine feasibility and benefits as well as potential adverse impacts. It may be a candidate for future priority lists.

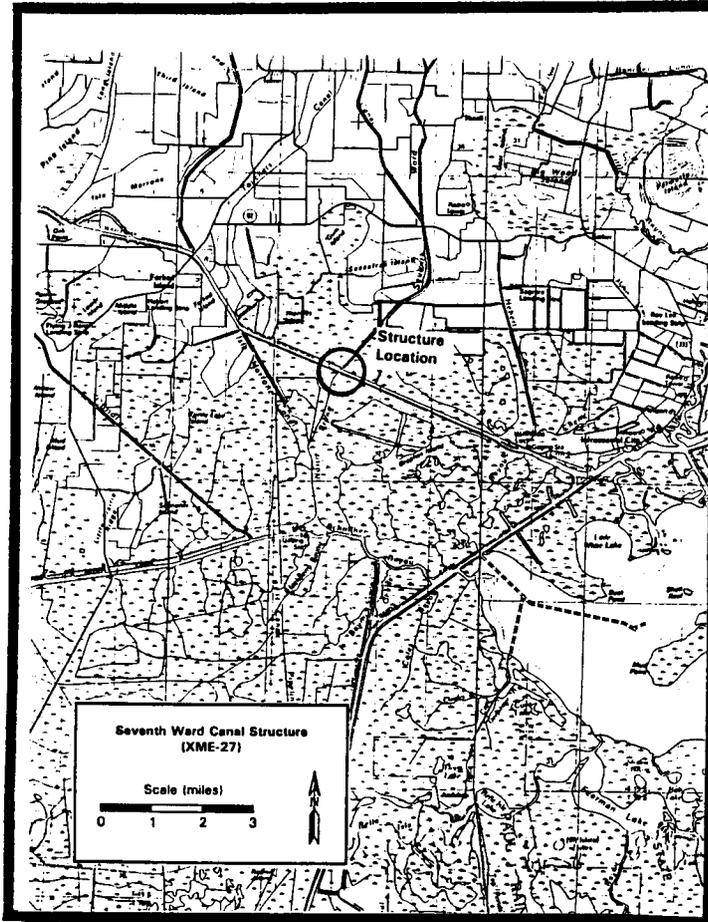


Figure 32. (XME-27) Seventh Ward Canal Structure

## SUPPORTING SHORT TERM PROJECTS

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### XME-28 GIWW/FRESHWATER BAYOU BANK STABILIZATION

#### Location

This project is located in the Lakes Sub-basin two miles southwest of Intracoastal City on the Freshwater Bayou Canal immediately south of its joining with the Gulf Intracoastal Waterway in Vermilion Parish, Louisiana (Figures 5 and 33). The project area encompasses 21 acres of fresh marsh along 8,000 feet on the west bank of the Freshwater Bayou Canal.

#### Problems and Opportunities

Freshwater Bayou was enlarged to a width of 300 feet to accommodate additional commercial boat traffic. As a consequence, increased tidal exchange, wave action, and wave wash from boat traffic has greatly increased shoreline erosion along Freshwater Bayou Canal, which has expanded in width to almost 600 feet. The existing spoil banks along sections of the channel have been eroded away, allowing tidal scouring and breakup of the adjacent marshes to occur. Without shoreline protection, the channel will continue to widen, consuming additional sections of spoil banks and adjacent marsh in the process. Shoreline stabilization will halt erosion and preserve habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

#### Description of Features

This project calls for 8,000 linear feet of rip-rap bank stabilization along the west bank of the Freshwater Bayou Canal beginning at its confluence with the GIWW.

#### Benefits and Costs

Wetland Value Assessment data indicate that the project is expected to protect 60 acres of fresh marsh at an estimated cost of \$700,000.

#### Effects and Issues

This project will halt erosion along this section of the Freshwater Bayou Canal thereby preserving valuable fresh marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

#### Status

This project is conceptual and requires study to determine feasibility of using rip-rap for bank stabilization or if another form of stabilization would be suitable and cost effective. It was a candidate for the CWPPRA 1993 Priority List but was not selected. It may be a candidate for future priority lists.

## XME-29 FRESHWATER BAYOU BANK STABILIZATION PHASE 3

### Location

This project is located in the Lakes Sub-basin 7 miles southwest of Intracoastal City on the Freshwater Bayou Canal at two locations with the first beginning at the confluence of Freshwater Bayou Canal and ending at the east bank oil field canal-adjacent to Belle Isle at the north end of the Freshwater Bayou Bank Stabilization project (XME-3) 1). The second section will begin at south end of XME-3 1 and extend southwards to the Humble Canal in Vermilion Parish, Louisiana (Figures 5 and 33). The project area encompasses 118 acres of fresh marsh habitat along 43,000 feet on the west bank of the Freshwater Bayou Canal.

### Problems and Onnortunities

Freshwater Bayou was enlarged to a width of 300 feet to accommodate additional commercial boat traffic. As a consequence, increased tidal exchange, wave action, and wave wash from boat traffic has greatly increased shoreline erosion along Freshwater Bayou Canal, which has expanded in width to almost 600 feet. The existing spoil banks along sections of the channel have been eroded away, allowing tidal scouring and breakup of the adjacent marshes to occur. Without shoreline protection, the channel will continue to widen, consuming additional sections of spoil banks and adjacent marsh in the process. Shoreline stabilization will halt erosion and preserve habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

### Description of Features

This project calls for 43,000 linear feet of rip-rap bank stabilization along the west bank of the Freshwater Bayou Canal at two locations with the first beginning at the confluence of Freshwater Bayou Canal and ending at the east bank oil field canal adjacent to Belle Isle at the north end of the Freshwater Bayou Bank Stabilization project (XME-3) 1). The second section will begin at south end of XME-3 1 and extend southwards to the Humble Canal.

### Benefits and Costs

The project is expected to protect 118 acres of fresh marsh and create conditions favorable for the expansion of submerged aquatic vegetation in the project vicinity at an estimated cost of \$3,762,500

### Effects and Issues

This project will halt erosion along this section of the Freshwater Bayou Canal thereby preserving valuable fresh marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

## SUPPORTING SHORT TERM PROJECTS

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### Status

This project is conceptual and requires study to determine feasibility of using rip-rap for bank stabilization or if another form of stabilization would be suitable and cost effective. It may be a candidate for future priority lists.

## XME-30 FRESHWATER BAYOU BANK STABILIZATION PHASE 4

### Location

This project is located in the Lakes Sub-basin 17 miles southwest of Intracoastal City on the Freshwater Bayou Canal immediately south of the Humble Canal in Vermilion Parish, Louisiana (Figures 5 and 33). The project area encompasses 36 acres of fresh marsh habitat along 13,000 feet on the west bank of the Freshwater Bayou Canal.

### Problems and Opportunities

Freshwater Bayou was enlarged to a width of 300 feet to accommodate additional commercial boat traffic. As a consequence, increased tidal exchange, wave action, and wave wash from boat traffic has greatly increased shoreline erosion along Freshwater Bayou Canal, which has expanded in width to almost 600 feet. The existing spoil banks along sections of the channel have been eroded away, allowing tidal scouring and breakup of the adjacent marshes to occur. Without shoreline protection, the channel will continue to widen, consuming additional sections of spoil banks and adjacent marsh in the process. Shoreline stabilization will halt erosion and preserve habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

### Description of Features

This project calls for 13,000 linear feet of rip-rap bank stabilization along the west bank of the Freshwater Bayou Canal beginning immediately south of the Humble Canal.

### Benefits and Costs

The project is expected to, protect 36 acres of fresh marsh and create conditions favorable for the expansion of submerged aquatic vegetation in the project vicinity at an estimated cost of \$1,137,500.

### Effects and Issues

This project will halt erosion along this section of the Freshwater Bayou Canal thereby preserving valuable fresh marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

Status

This project is conceptual and requires study to determine feasibility of using rip-rap for bank stabilization or if another form of stabilization would be suitable and cost effective. It may be a candidate for future priority lists.

XME-3 1 FRESHWATER BAYOU BANK STABILIZATION PHASE 5

Location

This project is located in the Lakes Sub-basin 8 miles southwest of Intracoastal City on the Freshwater Bayou Canal immediately south of the GIWW Freshwater Bayou Bank Stabilization project (XME-29) (northernmost segment) in Vermilion Parish, Louisiana (Figures 5 and 33). The project area encompasses 36 acres of fresh marsh habitat along 13,000 feet on the west bank of the Freshwater Bayou Canal.

Problems and Opportunities

Freshwater Bayou was enlarged to a width of 300 feet to accommodate additional commercial boat traffic. As a consequence, increased tidal exchange, wave action, and wave wash from boat traffic has greatly increased shoreline erosion along Freshwater Bayou Canal, which has expanded in width to almost 600 feet. The existing spoil banks along sections of the channel have been eroded away, allowing tidal scouring and breakup of the adjacent marshes to occur. Without shoreline protection, the channel will continue to widen, consuming additional sections of spoil banks and adjacent marsh in the process. Shoreline stabilization will halt erosion and preserve habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

Description of Features

This project calls for 13,000 linear feet of rip-rap bank stabilization along the west bank of the Freshwater Bayou Canal beginning at the south end of the GIWW/Freshwater Bayou Bank Stabilization project (XME-29) (northernmost segment).

Benefits and Costs

The project is expected to protect 36 acres of fresh marsh and create conditions favorable for the expansion of submerged aquatic vegetation in the project vicinity at an estimated cost of \$1,137,500.

Effects and Issues

This project will halt erosion along this section of the Freshwater Bayou Canal thereby preserving valuable fresh marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

## SUPPORTING SHORT TERM PROJECTS

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### Status

This project is conceptual and requires study to determine feasibility of using rip-rap for bank stabilization or if another form of stabilization would be suitable and cost effective. It may be a candidate for future priority lists.

## XME-32 FRESHWATER BAYOU BANK STABILIZATION PHASE 6

### Location

This project is located in the Lakes Sub-basin 3 miles southwest of Intracoastal City on the Freshwater Bayou Canal immediately south of the Freshwater Bayou Bank Stabilization project (XME-28) in Vermilion Parish, Louisiana (Figures 5 and 33). The project area encompasses 30 acres of fresh marsh habitat along 11,000 feet on the west bank of the Freshwater Bayou Canal.

### Problems and Opportunities

Freshwater Bayou was enlarged to a width of 300 feet to accommodate additional commercial boat traffic. As a consequence, increased tidal exchange, wave action, and wave wash from boat traffic has greatly increased shoreline erosion along Freshwater Bayou Canal, which has expanded in width to almost 600 feet. The existing spoil banks along sections of the channel have been eroded away, allowing tidal scouring and breakup of the adjacent marshes to occur. Without shoreline protection, the channel will continue to widen, consuming additional sections of spoil banks and adjacent marsh in the process. Shoreline stabilization will halt erosion and preserve habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

### Description of Features

This project calls for 11,000 linear feet of rip-rap bank stabilization along the west bank of the Freshwater Bayou Canal beginning at the south end of the GIWW/Freshwater Bayou Bank Stabilization project (XME-28).

### Benefits and Costs

The project is expected to protect 31 acres of fresh marsh and create conditions favorable for the expansion of submerged aquatic vegetation in the project vicinity at an estimated cost of \$1,000,000.

### Effects and Issues

This project will halt erosion along this section of the Freshwater Bayou Canal thereby preserving valuable fresh marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

Status

This project is conceptual and requires study to determine feasibility of using rip-rap for bank stabilization or if another form of stabilization would be suitable and cost effective. It may be a candidate for future priority lists.

XME-33 FRESHWATER BAYOU BANK STABILIZATION PHASE 7

Location

This project is located in the Lakes Sub-basin 5 miles southwest of Intracoastal City on the Freshwater Bayou Canal immediately south of Schooner Bayou in Vermilion Parish, Louisiana (Figures 5 and 33). The project area encompasses 25 acres of fresh marsh habitat along 9,000 feet on the west bank of the Freshwater Bayou Canal.

Problems and Opportunities

Freshwater Bayou was enlarged to a width of 300 feet to accommodate additional commercial boat traffic. As a consequence, increased tidal exchange, wave action, and wave wash from boat traffic has greatly increased shoreline erosion along Freshwater Bayou Canal, which has expanded in width to almost 600 feet. The existing spoil banks along sections of the channel have been eroded away, allowing tidal scouring and breakup of the adjacent marshes to occur. Without shoreline protection, the channel will continue to widen, consuming additional sections of spoil banks and adjacent marsh in the process. Shoreline stabilization will halt erosion and preserve habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

Description of Features

This project calls for 9,000 linear feet of rip-rap bank stabilization along the west bank of the Freshwater Bayou Canal beginning at the south bank of Schooner Bayou.

Benefits and Costs

The project is expected to protect 25 acres of fresh marsh and create conditions favorable for the expansion of submerged aquatic vegetation in the project vicinity at an estimated cost of \$787,500.

Effects and Issues

This project will halt erosion along this section of the Freshwater Bayou Canal thereby preserving valuable fresh marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

## SUPPORTING SHORT TERM PROJECTS

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### Status

This project is conceptual and requires study to determine feasibility of using rip-rap for bank stabilization or if another form of stabilization would be suitable and cost effective. It may be a candidate for future priority lists.

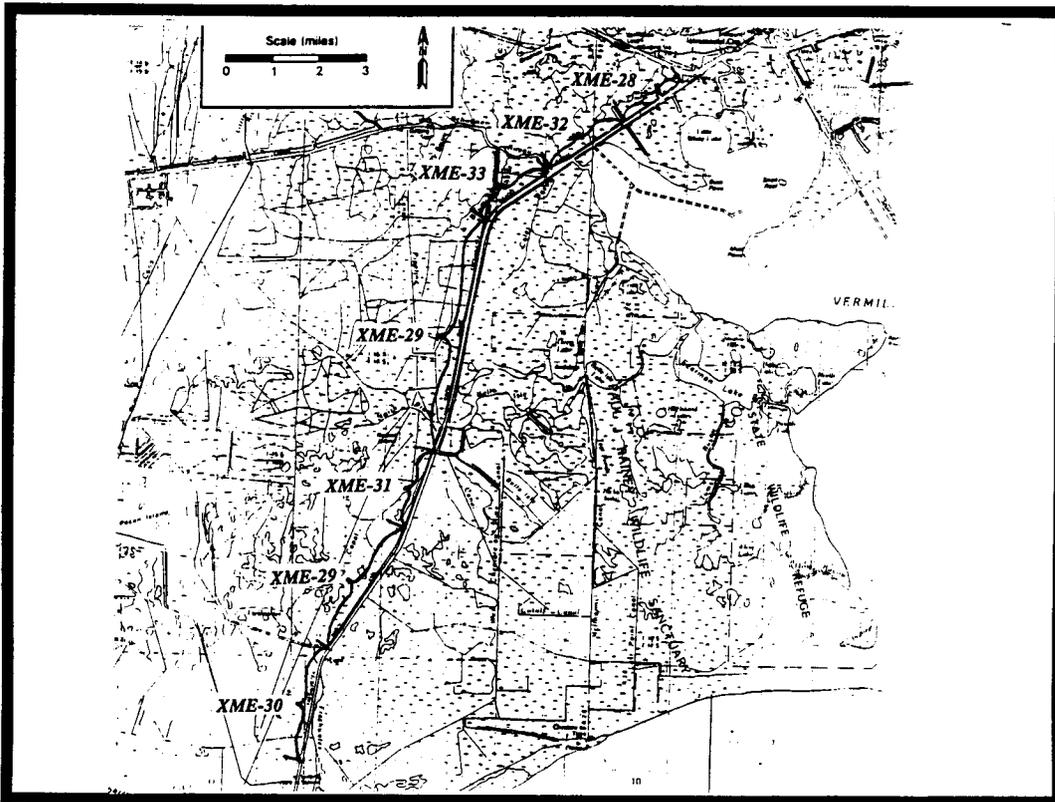


Figure 33. (XME-28 - XME-33) Freshwater Bayou Canal Bank Stabilization.

## XME-35A SHORELINE PROTECTION UMBRELLA BAY

### Location

This project is located in the Lakes Sub-basin on the eastern side of Grand Lake on the eastern Umbrella Bay shore in Cameron Parish, Louisiana (Figures 5 and 34). The project area encompasses 154 acres of fresh marsh habitat.

### Problems and Opportunities

Severe shoreline erosion (16 ft/yr) has breached into Lake Monzelum on the eastern shoreline of Umbrella Bay resulting in rapid loss of adjacent freshwater wetlands. Shoreline stabilization will reverse erosion and preserve habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

### Description of Features

This project calls for placement of segmented timber breakwaters offshore along 3,000 linear feet of the eastern Umbrella Bay shoreline.

### Benefits and Costs

The project is expected to create 17 acres of fresh marsh, protect 57 acres and create conditions favorable for the expansion of 4 acres of submerged aquatic vegetation in the project vicinity at an estimated cost of **\$1, 100,000**.

### Effects and Issues

This project will reverse erosion along this section of shoreline by blocking wave fetch and encouraging sediment deposition landward of the breakwaters thereby creating and preserving valuable fresh marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

### Status

This project is conceptual and requires study to determine feasibility and the overall effectiveness of using timber breakwaters for bank stabilization or if another form of stabilization would be suitable and cost effective. It may be a candidate for future priority lists.

## SUPPORTING SHORT TERM PROJECTS

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### XME-35B SHORELINE PROTECTION MALLARD BAY

#### Location

This project is located in the Lakes Sub-basin on the eastern side of Grand Lake on the southwestern Mallard Bay shore in the vicinity of Bird Island in Cameron Parish, Louisiana (Figures 5 and 34). The project area encompasses 154 acres of fresh marsh habitat.

#### Problems and Opportunities

Severe shoreline erosion (12 ft/yr) on the southwestern shoreline of Mallard Bay is resulting in rapid loss of adjacent freshwater wetlands and threatening the Mallard Bay Peninsula. Shoreline stabilization will reverse erosion and preserve habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

#### Description of Features

This project calls for placement of segmented timber breakwaters offshore along 2,500 linear feet of the southwestern Mallard Bay shoreline.

#### Benefits and Costs

The project is expected to create 17 acres of fresh marsh, protect 57 acres and create conditions favorable for the expansion of 4 acres of submerged aquatic vegetation in the project vicinity at an estimated cost of \$900,000.

#### Effects and Issues

This project will reverse erosion along this section of shoreline by blocking wave fetch and encouraging sediment deposition landward of the breakwaters thereby creating and preserving valuable fresh marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

#### Status

This project is conceptual and requires study to determine feasibility and the overall effectiveness of using timber breakwaters for bank stabilization or if another form of stabilization would be suitable and cost effective. It may be a candidate for future priority lists.

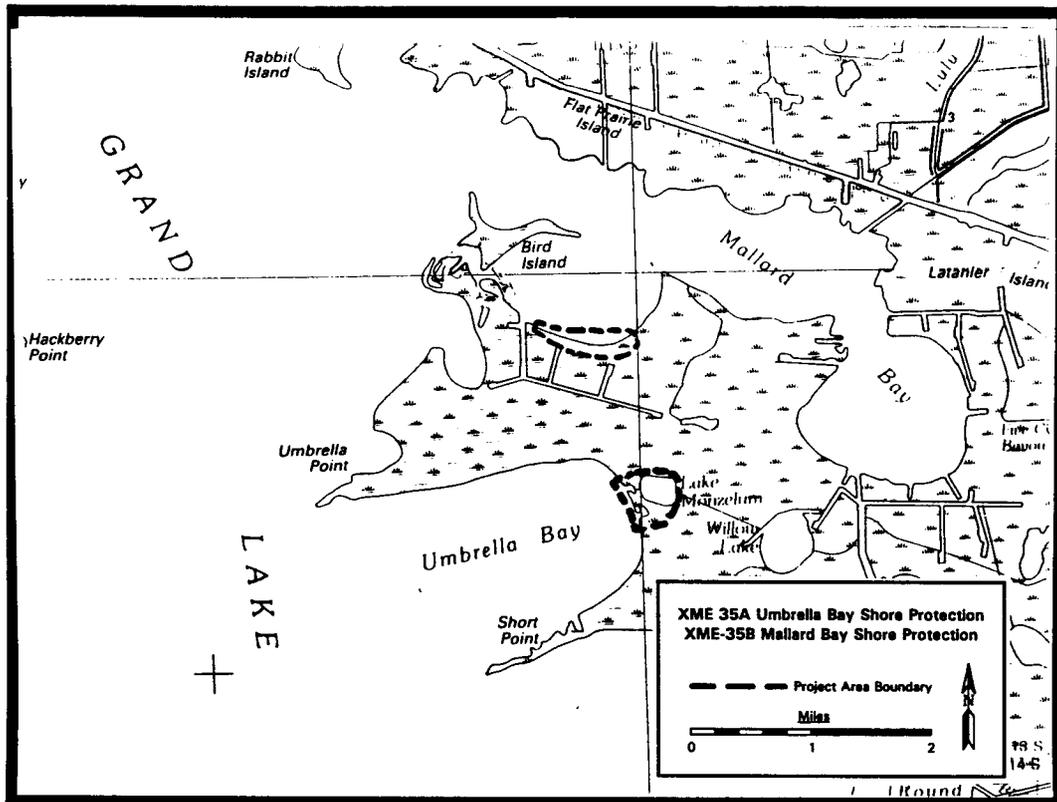


Figure 34. (XME-35a) Umbrella Bay Shore Protection.  
(XME-35b) Mallard Bay Shore Protection.

## SUPPORTING SHORT TERM PROJECTS

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### XME-36 TEBO POINT

#### Location

This project is located in the Lakes Sub-basin on the southwestern shore of Grand Lake at Tebo Point in Cameron Parish, Louisiana (Figures 5 and 35). The project area encompasses 21 acres of fresh marsh habitat.

#### Problems and Opportunities

Severe shoreline erosion (11 ft/yr) has severely eroded Tebo Point and the peninsula that once protected Catfish Lake from wave fetch across Grand Lake. This has resulted in greater erosion rates along the Catfish Lake shoreline. Shoreline stabilization using rock breakwater will reverse erosion and preserve habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

#### Description of Features

This project calls for placement of rock breakwater offshore along 4,000 linear feet of the Tebo Point Peninsula.

#### Benefits and Costs

The project is expected to create and protect 9 acres of fresh marsh as well as enhance 2 acres of submerged aquatic vegetation in the project vicinity at an estimated cost of \$200,000.

#### Effects and Issues

This project will reverse erosion along this section of shoreline by blocking wave fetch and encouraging sediment deposition landward of the breakwaters thereby creating and preserving valuable fresh marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

#### Status

This project is conceptual and requires study to determine feasibility and the overall effectiveness of using rock breakwater for bank stabilization or if another form of stabilization would be suitable and cost effective. It may be a candidate for future priority lists.

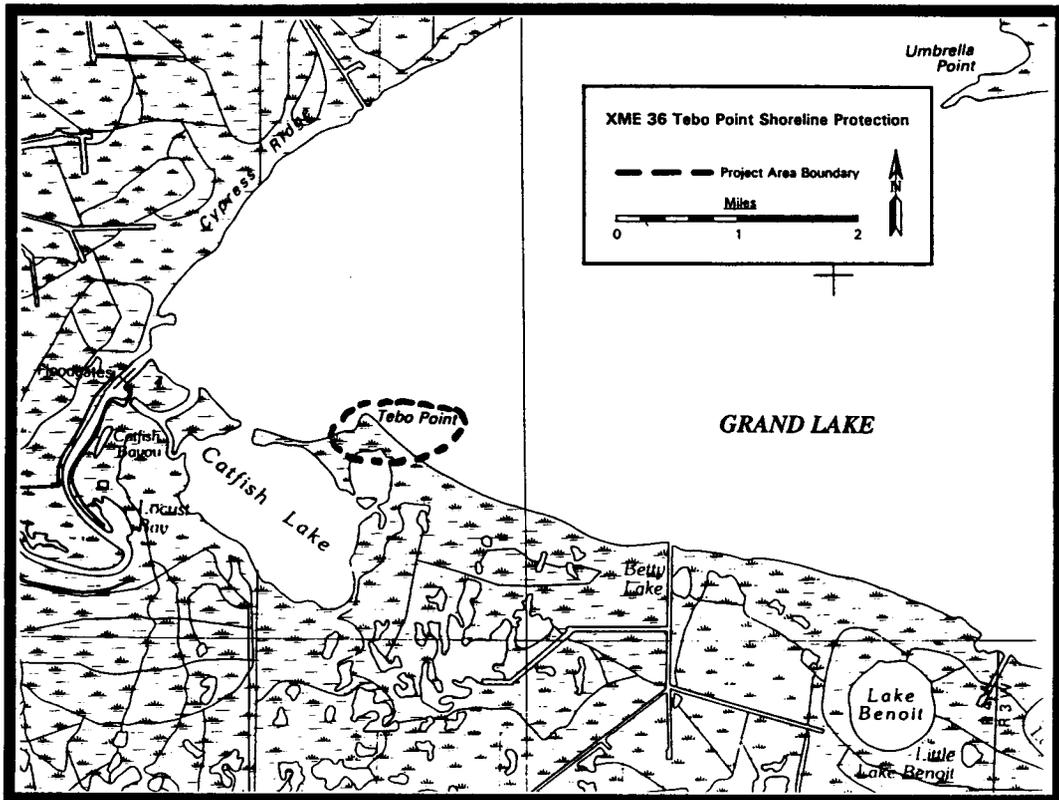


Figure 35. (XME-36) Tebo Point Shoreline Protection.

## SUPPORTING SHORT TERM PROJECTS

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### XME-37 CHENIER DU FOND SHORELINE PROTECTION

#### Location

This project is located in the Lakes Sub-basin on the southeastern shore of Grand Lake at Chenier du Fond in Cameron Parish, Louisiana (Figures 5 and 36). The project area encompasses 31 acres of fresh marsh habitat.

#### Problems and Opportunities

Severe shoreline erosion (14 ft/yr) has severely eroded Chenier du Fond resulting in the loss of adjacent fresh marsh habitat. Shoreline stabilization using rip-rap placed in shallow water will reverse erosion and preserve habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

#### Description of Features

This project calls for placement of rip-rap placed in shallow water along 10,500 linear feet of Grand Lake shoreline.

#### Benefits and Costs

The project is expected to create and project 15 acres of fresh marsh as well as enhance 3 acres of submerged aquatic vegetation for a total benefit of 18 acres at an estimated cost of \$840,000.

#### Effects and Issues

This project will reverse erosion along this section of shoreline by blocking wave fetch and encouraging sediment deposition landward of the breakwaters thereby creating and preserving valuable fresh marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

#### Status

This project is conceptual and requires study to determine feasibility and the overall effectiveness of using rip-rap for bank stabilization or if another form of stabilization would be more suitable and cost effective. It may be a candidate for future priority lists.

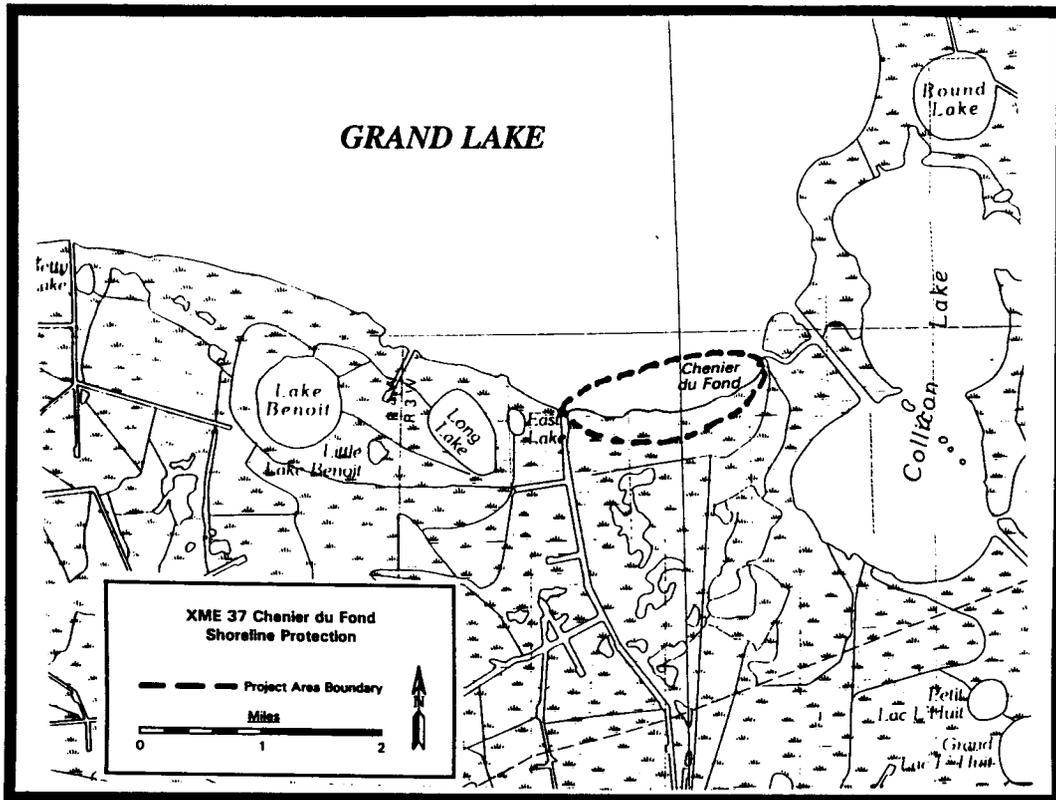


Figure 36. (XME-37) Chenier du Fond Shoreline Protection.

## SUPPORTING SHORT TERM PROJECTS

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### XME38 GRAND VOLLE LAKE TO BEAR LAKE SHORELINE PROTECTION

#### Location

This project is located in the Lakes Sub-basin on the southwestern shore of White Lake at Grand Volle and Bear Lakes in Cameron Parish, Louisiana (Figures 5 and 37). The project area encompasses 364 acres of fresh marsh habitat.

#### Problems and Opportunities

Severe shoreline erosion (6-18 ft/yr) on White Lake has severely eroded the shoreline that once separated Grand Volle and Bear Lakes from White Lake exposing them to wave fetch across White Lake. This has resulted in greater erosion rates along the lake shorelines. Shoreline stabilization using rip-rap breakwaters will reverse erosion by increasing sediment deposition in the lee of the breakwaters thereby preserving habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

#### Description of Features

This project calls for placement of rip-rap breakwater placed in shallow water along 12,500 linear feet of White Lake shoreline.

#### Benefits and Costs

The project is expected to protect 204 acres of fresh marsh and enhance 38 acres of submerged aquatic vegetation for a total benefit of 242 acres at an estimated cost of \$1,000,000.

#### Effects and Issues

This project will reverse erosion along this section of shoreline by blocking wave fetch and encouraging sediment deposition landward of the breakwater thereby creating and preserving valuable fresh marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

#### Status

This project is conceptual and requires study to determine feasibility and the overall effectiveness of using rock breakwater for bank stabilization or if another form of stabilization would be suitable and cost effective. It may be a candidate for future priority lists.

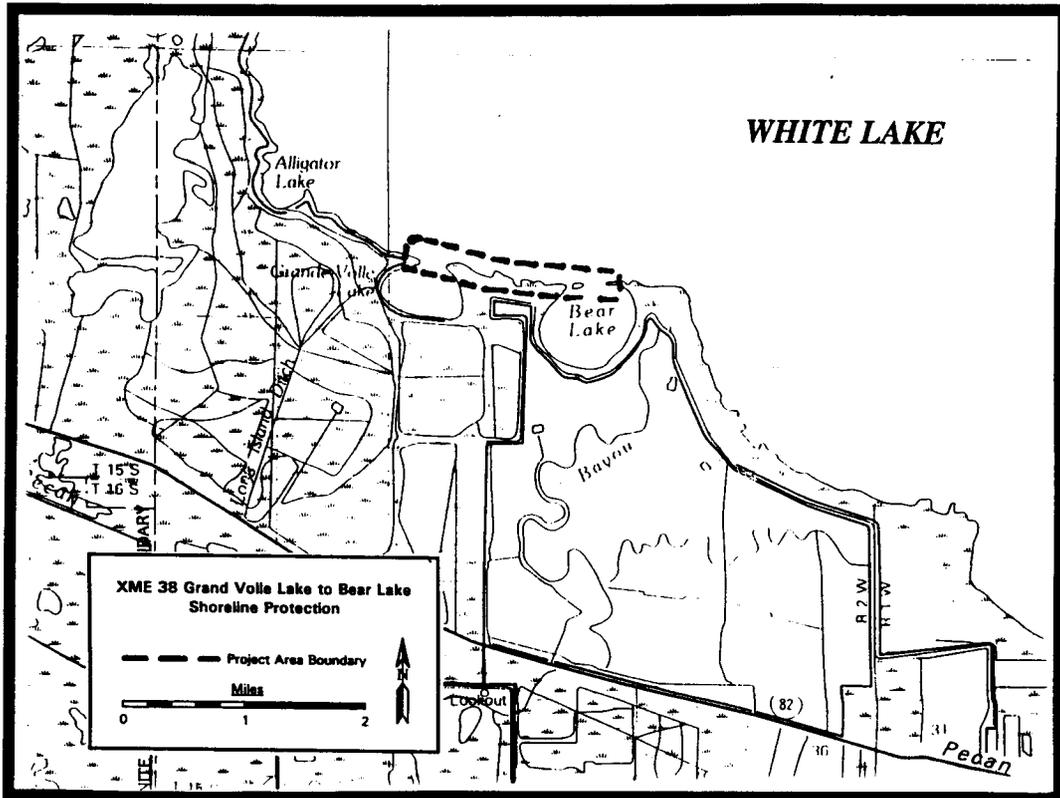


Figure 37. (XME-38) Grand Volle Lake to Bear Lake Shoreline Protection.

## SUPPORTING SHORT TERM PROJECTS

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### XME-40 NORTH LITTLE PECAN BAYOU

#### Location

This project is located in the Lakes Sub-basin on between Grand Lake and Little Pecan Bayou in Cameron Parish, Louisiana (Figures 5 and 38). The project area is bordered on the north by Catfish Lake, on the south by Little Pecan Bayou, on the east--by the Mermentau River, and on the west by an unnamed oil field canal. The area encompasses 4,467 acres of intermediate marsh habitat.

#### Problems and Opportunities

Wetland in this area is being lost as a result of saltwater intrusion from the Mermentau River entering the management area through Little Pecan Bayou and excessive water levels that stress marsh vegetation. This area has been under active management since the mid-1980's and is in need of structure maintenance and repair. The north levee on Little Pecan Bayou is in need of repair to prevent saltwater from entering the project area. Three (3) 48-inch flapgated culverts with variable crest weirs will replace an existing structure on Little Pecan Bayou. This will help to control water levels, halt saltwater intrusion and restore full management capability in the marsh.

#### Description of Features

This project calls for three (3) 48-inch flapgated culverts with variable crest weirs on Little Pecan Bayou and 9,000 linear feet of levee reconstruction on Little Pecan Bayou.

#### Benefits and Costs

The project is expected to protect 117 acres of fresh marsh, enhance 278 acres and create conditions favorable for the expansion of 372 acres of submerged aquatic vegetation in the project vicinity at an estimated cost of \$1,400,000.

#### Effects and Issues

This project will halt land loss in this area by blocking saltwater intrusion and controlling water levels thereby preserving valuable habitat for the benefit of wetland dependent fish and wildlife populations. Fisheries access will likely be reduced by water control structures in the area although resident fishery productivity may be enhanced.

#### Status

This project may be a candidate for future priority lists.

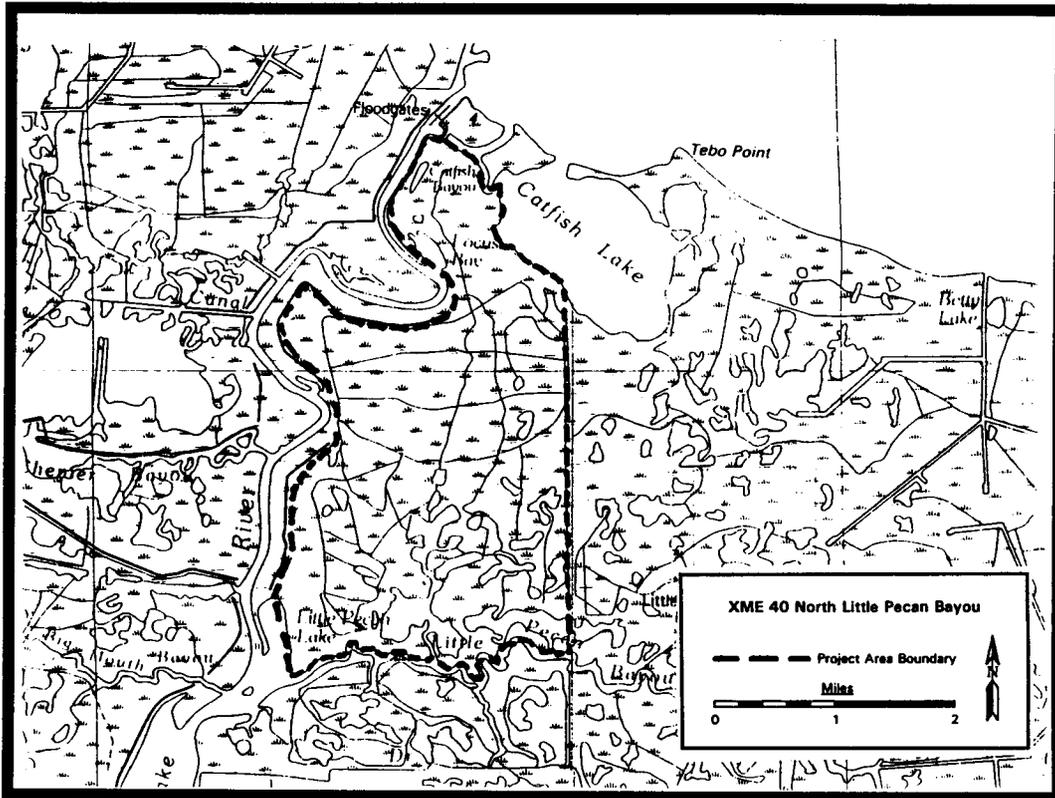


Figure 38. (XME-40) North Little Pecan Bayou.

### XME-43 FLORENCE CANAL

#### Location

This project is located in the Lakes Sub-basin on the west bank of the Florence Canal north of White Lake in Vermilion Parish, Louisiana (Figures 5 and 39). The acreage of this project area has not been determined.

#### Problems and Opportunities

Shoreline erosion along the Florence Canal has deteriorated the western spoil bank to the extent that adjacent fresh marsh is being lost due to saltwater intrusion from the canal. Levee repair in this area will halt saltwater intrusion and slow land loss thereby preserving habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

#### Description of Features

This project calls for levee restoration along 10,000 linear feet of the Florence Canal west bank.

#### Benefits and Costs

The project will halt saltwater intrusion and slow land loss west of the Florence canal. Rapid protocol Wetland Value Assessment data is unavailable for this project making benefit acreage information nonexistent at the time of this writing. It is estimated that this project will protect at least 500 acres of fresh marsh and create condition favorable to the expansion of submerged aquatic vegetation. This project is estimated to cost \$350,000.

#### Effects and Issues

The project will halt saltwater intrusion and slow land loss west of the Florence canal thereby preserving valuable fresh marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

#### Status

This project is conceptual and may be a candidate for future priority lists.

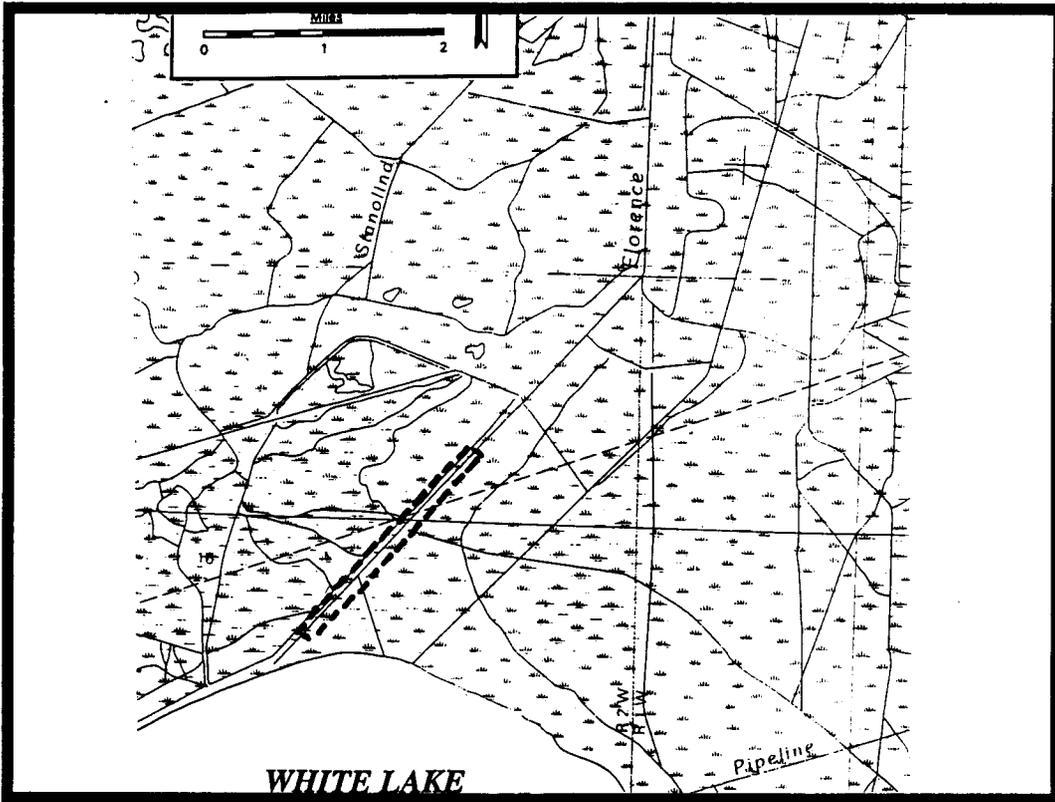


Figure 39. (XME-43) Florence Canal

## SUPPORTING SHORT TERM PROJECTS

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### XME-44 GIWW BANK STABILIZATION VERMILION/CAMERON PARISHLINE

#### Location

This project is located in the Lakes Sub-basin on the south bank of the Gulf Intracoastal Waterway at the Vermilion/Cameron Parish boundary, Louisiana (Figures 5 and 40). The project area encompasses 50 acres of fresh/intermediate marsh habitat.-

#### Problems and Opportunities

Severe shoreline erosion has breached the south bank of the GIWW allowing saltwater intrusion into adjacent wetlands threatening the loss of fresh marsh habitat. Shoreline stabilization using rip-rap placed in shallow water will reverse erosion and preserve habitat for wetland dependent fish and wildlife. This project is compatible with the basin strategy of maintaining the geologic framework of the basin by controlling erosion of shorelines and navigation channels.

#### Description of Features

This project calls for placement of rip-rap placed in shallow water along 7,000 linear feet of GIWW shoreline on the south bank in the vicinity of the Vermilion and Cameron Parish boundary.

#### Benefits and Costs

The project is expected to create 10 acres of marsh, protect 10 acres, enhance 2 acres and create conditions favorable for the expansion of 1 acre of submerged aquatic vegetation at an estimated cost of \$620,000.

#### Effects and Issues

This project will reverse erosion along this section of shoreline by blocking wave fetch and encouraging sediment deposition landward of the breakwater thereby creating and preserving valuable fresh marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

#### Status

This project is conceptual and requires study to determine feasibility and the overall effectiveness of using rip-rap for bank stabilization or if another form of stabilization would be more suitable and cost effective. This project interacts with (PME-1) GIWW Bank Protection. It may be a candidate for future priority lists.

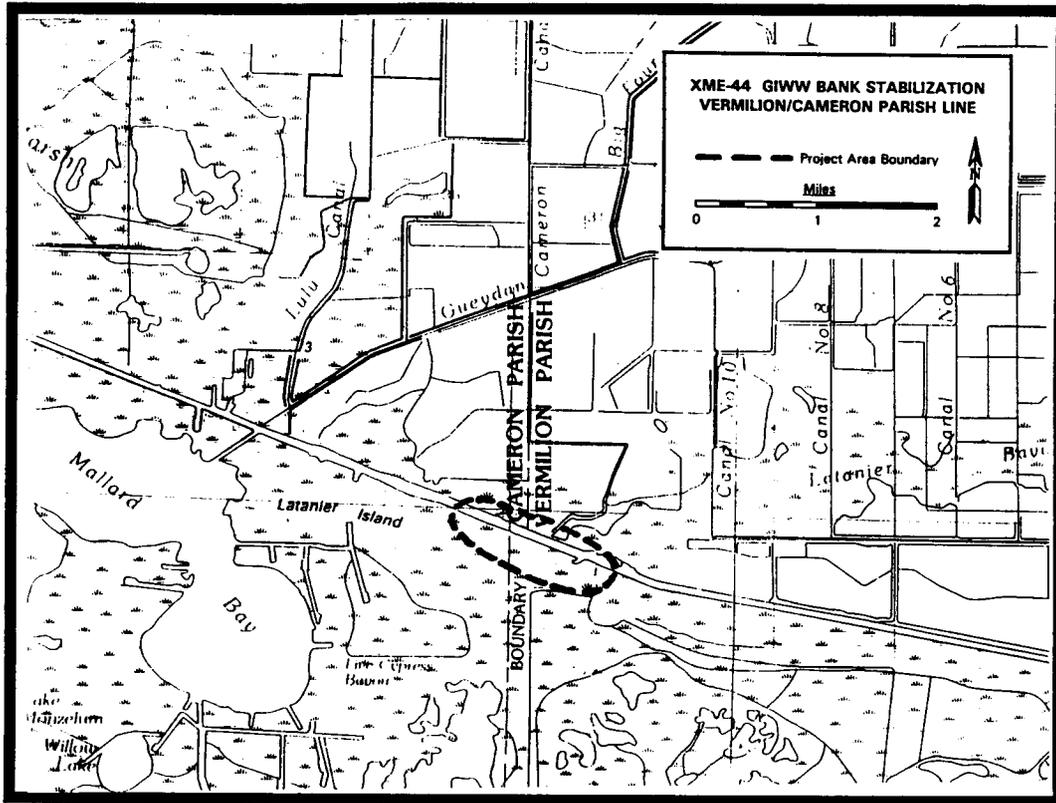


Figure 40. (XME-44) GIWW Bank Stabilization Vermilion/Cameron Parish Line.

## SUPPORTING SHORT TERM PROJECTS

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### XME-45 PUMPKIN RIDGE STRUCTURE

#### Location

This project is located in the Chenier Sub-basin on the Mermentau River one mile north of Lower Mud Lake near the mouth of Rings Bayou in Cameron Parish, Louisiana (Figures 5 and 41). The area encompasses 1,000 acres of intermediate and low salinity brackish marsh habitat.

#### Problems and Opportunities

Wetland in this area is being lost as a result of saltwater intrusion from the Mermentau River entering the project area via a small canal approximately 500 feet east of Rings Bayou. The existing water control structure which, in the past have provided protection from saltwater intrusion, have deteriorated and no longer function as designed. Replacing the existing structure with a flapgated culvert with variable crest weir type structure will halt saltwater intrusion into the marsh. This project is compatible with the basin strategy of treating critical areas of wetland loss within the interior of the basin.

#### Description of Features

This project calls replacing the existing structure with a flapgated culvert type structure with a variable crest weir.

#### Benefits and Costs

The project is expected to protect 15 acres of marsh, enhance 65 acres and create conditions favorable for the expansion of 56 acres of submerged aquatic vegetation in the project vicinity at an estimated cost of \$700,000.

#### Effects and Issues

This project will reduce land loss in this area by blocking saltwater intrusion and controlling water levels thereby preserving valuable habitat for the benefit of wetland dependent fish and wildlife populations. Fisheries access will continue to be reduced by water control structures in the area although resident fishery productivity may be enhanced.

#### Status

This project may be a candidate for future priority lists.

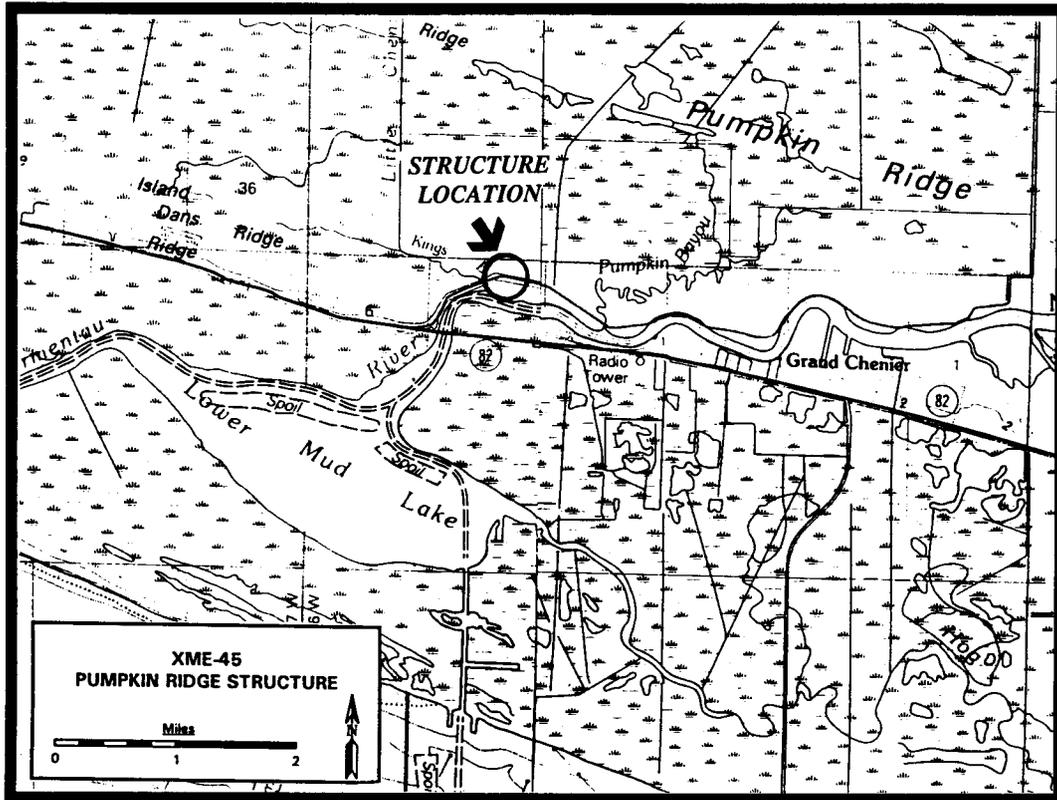


Figure 41. (XME-45) Pumpkin Ridge Structure.

## SUPPORTING SHORT TERM PROJECTS

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### XME-46 ROLLOVER BAYOU STRUCTURE

#### Location

This project is located in the Chenier Sub-basin on Rollover Bayou approximately 2,000 feet north of the mouth of the bayou in Cameron Parish, Louisiana (Figures 5 and 42). The area encompasses 4,000 acres of brackish and saline marsh habitat.

#### Problems and Opportunities

Wetland in this area is being lost as a result of saltwater intrusion from Rollover Bayou. The existing water control structures which, in the past have provided protection from saltwater intrusion have deteriorated such that they no longer function as designed. Replacing the existing structure with a weir and boat bay large enough for shrimp boats to pass through will significantly reduce saltwater intrusion into the marsh. This project is compatible with the basin strategy of treating critical areas of wetland loss within the interior of the basin.

#### Description of Features

This project calls replacing the existing structure on Rollover Bayou with a weir with a large boat bay.

#### Benefits and Costs

The project is expected to protect 150 acres of marsh, enhance 179 acres and create conditions favorable for the expansion of 272 acres of submerged aquatic vegetation in the project vicinity at an estimated cost of \$400,000.

#### Effects and Issues

This project will reduce land loss in this area by blocking saltwater intrusion and controlling water levels thereby preserving valuable habitat for the benefit of wetland dependent fish and wildlife populations. Fisheries access will continue to be reduced by water control structures in the area although resident fishery productivity may be enhanced.

#### Status

This project may be a candidate for future priority lists.

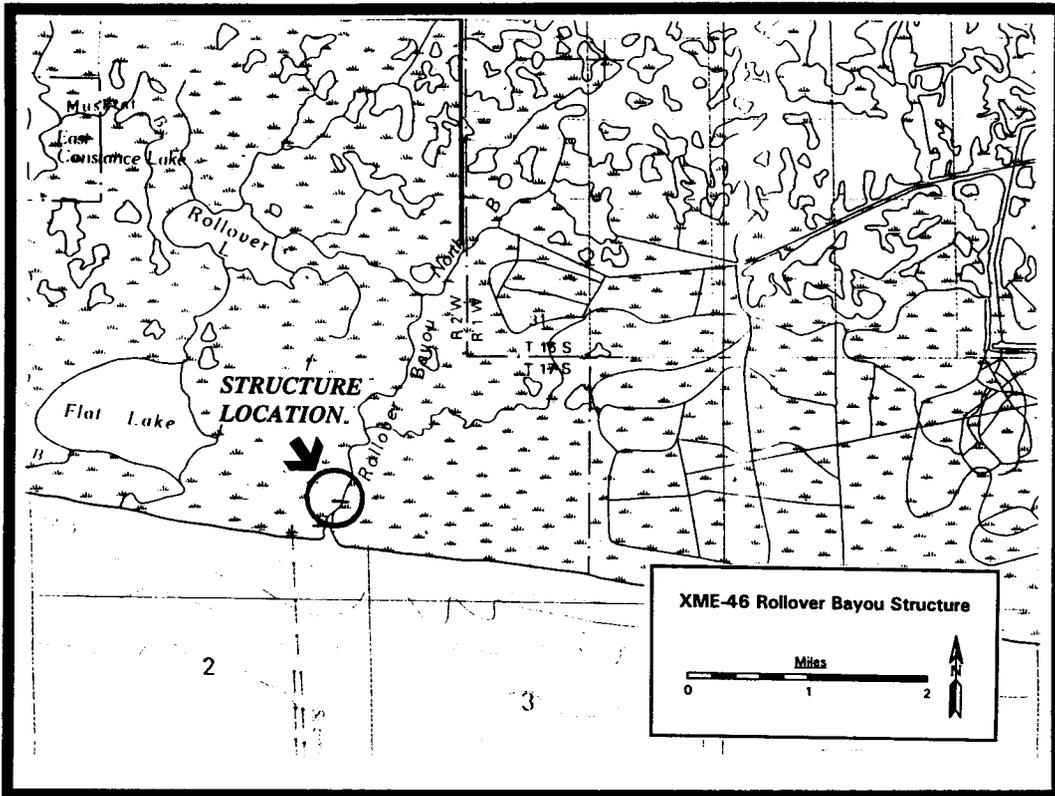


Figure 42. (XME-46) Rollover Bayou Structure.

## SUPPORTING LONG TERM PROJECTS

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### SUPPORTING LONG TERM PROJECTS

#### PME-8 MIAMI CORP. SOUTH LEVEE

##### Location

This project is located in the Lakes Sub-basin just north of Little Chenier Ridge between LA 27 and the Mermentau River in Cameron Parish, Louisiana (Figures 5 and 43). The acreage of this project area has not been determined.

##### Problems and Opportunities

Excessive water levels in the Lakes Sub-basin are stressing wetland vegetation in this area and causing flooding problems on the Little Chenier Ridge. Construction of a continuous levee north of the ridge between LA 27 and the Mermentau River will alleviate flooding on Little Chenier Ridge and provide better water level management capabilities in the marsh north of the proposed levee. This project is compatible with the basin strategy of treating critical areas of wetland loss within the interior of the basin.

##### Description of Features

This project calls for installation of 50,000 linear feet of levee north of Little Chenier Ridge between LA 27 and the Mermentau River.

##### Benefits and Costs

Rapid protocol Wetland Value Assessment data is unavailable for this project making benefited acreage information nonexistent at the time of this writing. This project is estimated to cost \$2,380,000.

##### Effects and Issues

The project will provide flood protection for the Little Chenier Ridge and better water level management capabilities for marshes north of the ridge thereby preserving valuable fresh and intermediate marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

##### Status

This project is conceptual and requires feasibility study and design. It may be a candidate for future priority lists.

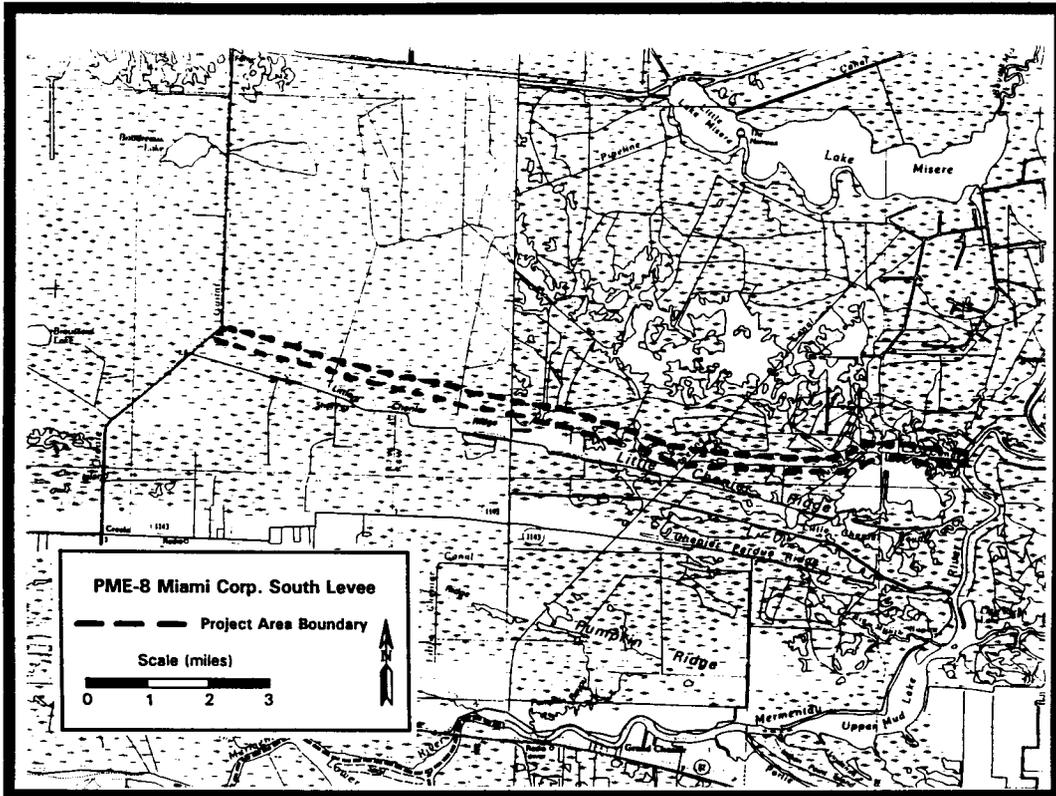


Figure 43. (PME-8) Miami Corporation South Levee.

## SUPPORTING LONG TERM PROJECTS

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### PME-10 LITTLE PECAN BAYOU VEGETATIVE PLANTING

#### Location

This project is located in the Lakes Sub-basin west of Upper Mud Lake along 50,000 feet of Little Pecan Bayou in Cameron Parish, Louisiana (Figures 5 and 44). The acreage of this project area has not been determined.

#### Problems and Opportunities

Bank erosion along Little Pecan Bayou is resulting in the loss of adjacent intermediate wetland. There is an opportunity to help stabilize the banks of the bayou by planting suitable vegetation that can tolerate salinity levels in the bayou to protect vegetation that is not as salt tolerant adjacent to the bayou's natural levee. This project is compatible with the basin strategy of maintaining the geologic framework of the interior basin by controlling erosion of shorelines and navigation channels.

#### Description of Features

This project calls for planting Smooth cordgrass, *Spartina alterniflora* along 50,000 linear feet bank line on Little Pecan Bayou. Details on the number of plants and spacing is unavailable at the time of this writing.

#### Benefits and Costs

Rapid protocol Wetland Value Assessment data is unavailable for this project making benefited acreage information nonexistent at the time of this writing. This project is estimated to cost \$300,000.

#### Effects and Issues

The project will slow bank erosion along the natural levee on Little Pecan Bayou thereby preserving valuable intermediate marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

#### Status

This project is conceptual and requires feasibility and design. It may be a candidate for future priority lists.

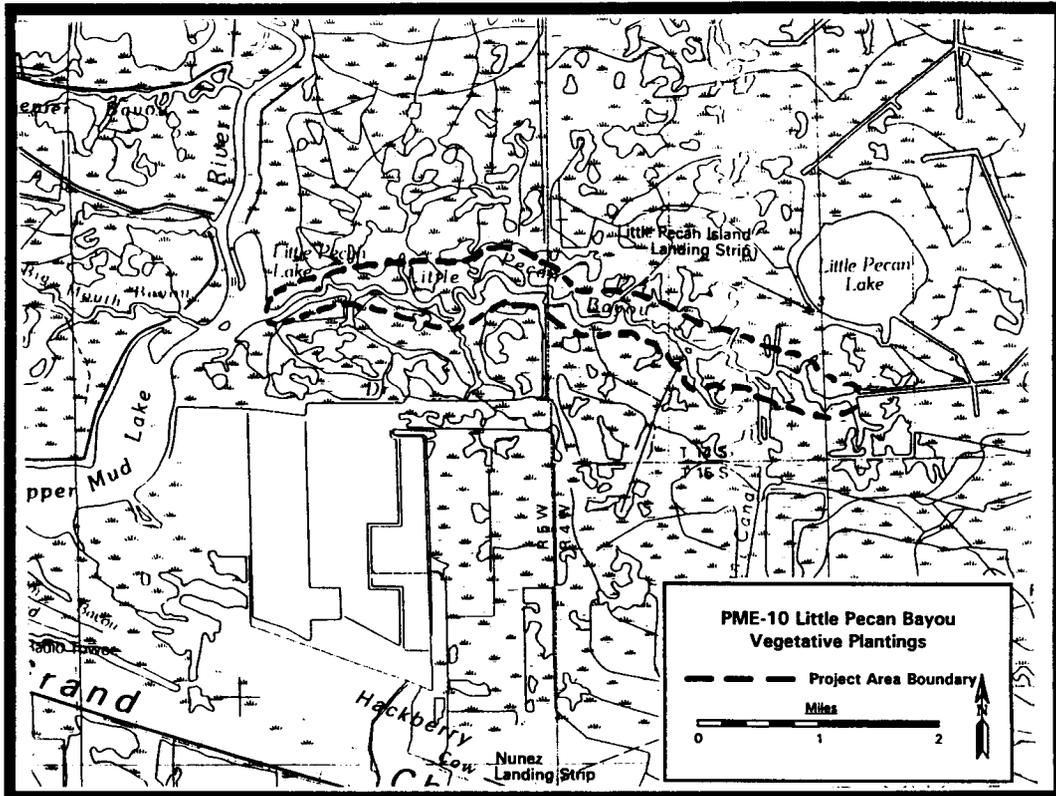


Figure 44. (PME-10) Little Pecan Bayou Vegetative Plantings.

### PME -11 GIWW VEGETATIVE PLANTINGS

#### Location

This project is located in the Lakes Sub-basin along 34 miles of shoreline south of the GIWW spoil bank between the Calcasieu Lock and Grand Lake in Cameron Parish and part of Calcasieu Parish, Louisiana (Figures 5 and 45). The acreage of this project area has not been determined. Approximately 50% of this proposed planting would fall in the Calcasieu/Sabine Basin.

#### Problems and Opportunities

Bank erosion along the GIWW is resulting in the loss of adjacent intermediate wetland. There is an opportunity to provide a diversity of wildlife habitat by planting Bald cypress, *Taxodium distichum* south of the GIWW spoil bank. This project would help to stabilize the banks of the GIWW and also provide a seed source for future generations of Bald cypress. This project is compatible with the basin strategy of maintaining the geologic framework of the interior basin by controlling erosion of shorelines and navigation channels.

#### Description of Features

This project calls for planting Bald cypress, *Taxodium distichum* along approximately 334 linear miles of the south GIWW spoil bank between the Calcasieu Lock and Grand Lake. Details on the number of plants and spacing is unavailable at the time of this writing.

#### Benefits and Costs

Rapid protocol Wetland Value Assessment data is unavailable for this project making benefited acreage information nonexistent at the time of this writing. This project is estimated to cost \$800,000.

#### Effects and Issues

The project will slow bank erosion along GIWW thereby preserving creating valuable fresh marsh and cypress swamp habitat for the benefit of wetland dependent and non-wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

#### Status

This project is conceptual and requires feasibility and design. It may be a candidate for future priority lists.

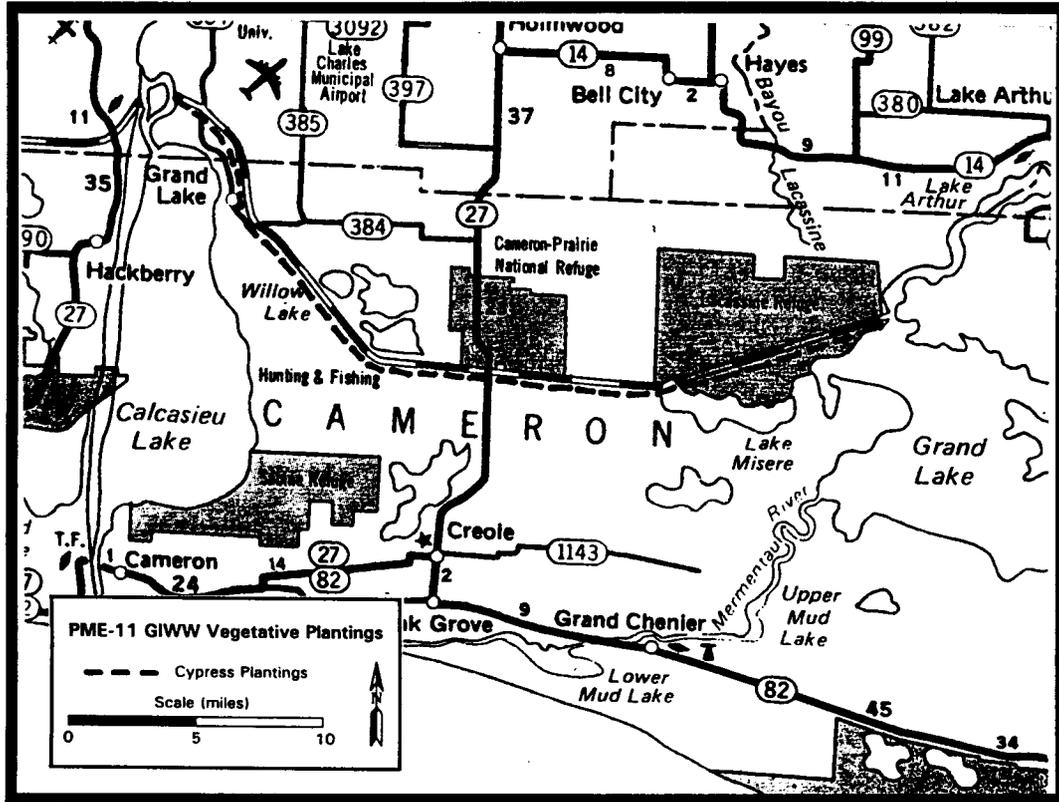


Figure 45. (PME-11) GIWW Vegetative Plantings.

## SUPPORTING LONG TERM PROJECTS

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### PME-16 COTEAU PLATEAU MARSH

#### Location

This project is located in the Chenier Sub-basin west of Lower Mud Lake in the area between the East Creole and Little Chenier cheniers in the area known as Middle Marsh in Cameron Parish, Louisiana (Figures 5 and 46). The project area is bordered on the north by Little Chenier Ridge, on the south by the East Creole Ridge, on the east by a state road connecting the two cheniers, and on the west by LA 27. The area encompasses 7,300 acres of fresh and intermediate marsh habitat.

#### Problems and Opportunities

The Coteau Plateau Marsh has been periodically affected by saltwater intrusion, winter droughts, freezes and lengthy spring and summer droughts and floods. Saltwater intrudes via the Oak Grove Water Control Structure (WCS). Water management at the Oak Grove WCS connects several marshes that exist at different elevation. This broad application of water management to several marsh systems often leaves one marsh dry and another marsh flooded. Furthermore, this marsh is often inundated during prime germination and vegetative growth periods. This flooding is caused by the greatly enhanced drainage patterns in the northern reaches of the Mermentau and Calcasieu Watersheds and the degrading drainage caused by the Mermentau River Jetties. Placing the Coteau Plateau Marsh under structural management will allow for enhanced wetland productivity and habitat diversity. This project is compatible with the basin strategy of treating critical areas of wetland loss within the interior of the basin.

#### Description of Features

Details of this plan remain to be worked out but will likely include flapgated culverts with variable crest weirs under LA 27 or similar type structures.

#### Benefits and Costs

Rapid protocol Wetland Value Assessment data is unavailable for this project making benefited acreage information nonexistent at the time of this writing. This project is estimated to cost \$900,000.

#### Effects and Issues

This project will halt land loss in this area by blocking saltwater intrusion and controlling water levels thereby creating and preserving valuable habitat for the benefit of wetland dependent fish and wildlife populations. Fisheries access will likely be reduced by water control structures in the area although resident fishery productivity may be enhanced.

#### Status

This project is conceptual and requires feasibility and design. It may be a candidate for future priority lists.

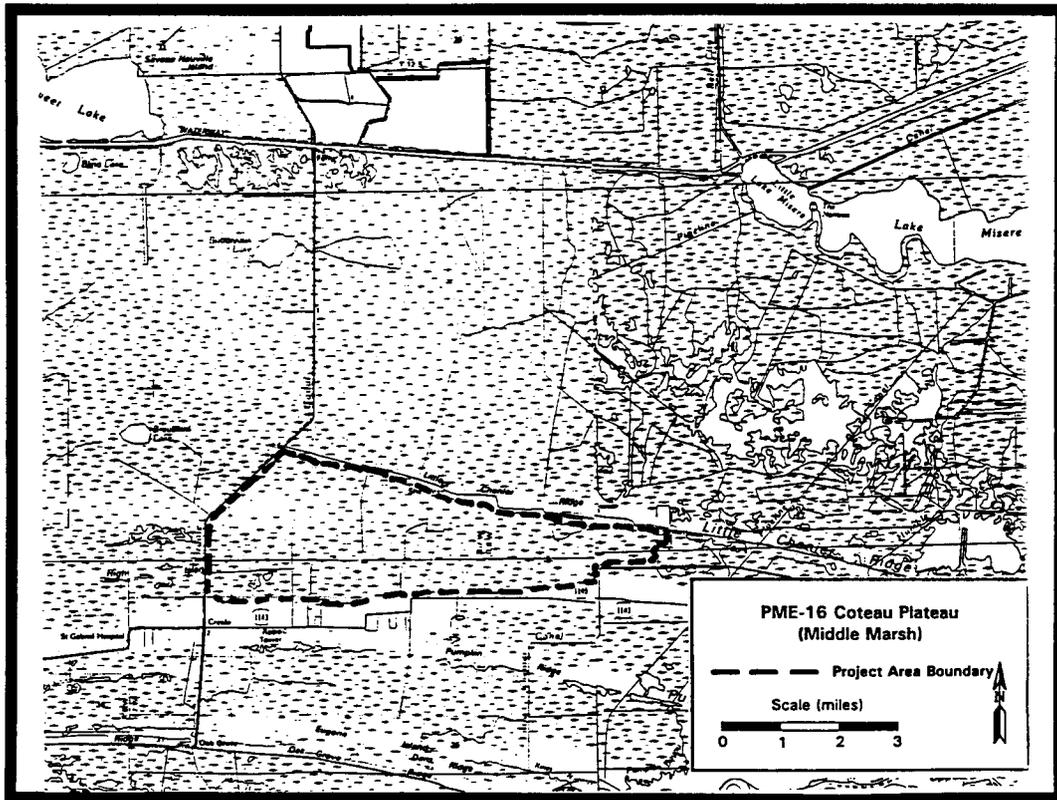


Figure 46. (PME-16) Coteau Plateau Marsh.

## XME-34 OAR GROVE CANAL CLEANOUT/FRESHWATER DIVERSION

### Location

This project is located in the Lakes and Chenier Sub-basins on the Oak Grove Canal (a.k.a. Creole Canal) immediately west of LA 27 between the GIWW and the Mermentau River in Cameron Parish, Louisiana (Figures 5 and 47). Benefited acreage of this fresh and intermediate marsh habitat has not been determined.

### Problems and Opportunities

The marshes south of the GIWW are highly susceptible to extended periods of over bank flooding. This does provide for marsh nutrition; however, the northern drainage patterns have become impounded systems. The Oak Grove Canal should be opened at the GIWW and re-dug to the Mermentau River. The Oak Grove Water Control Structure should be removed and a new structure placed where the canal intersects the Mermentau River. All water entrances from the adjoining marshes must be structured to allow for the maximum outflow of excess water and the controlled inflow of muddy water. This project is compatible with the basin strategy of developing additional outlets to outside channels or water bodies to discharge flood waters more rapidly.

### Description of Features

Open the Oak Grove Canal at the Gulf Intracoastal Waterway and clean out the canal (including removal of all plugs) all the way to the Mermentau River. Install a water control structure at the canal's intersection with the Mermentau River. All details on this plan remain to be determined.

### Benefits and Costs

Rapid protocol Wetland Value Assessment data is unavailable for this project making benefited acreage information nonexistent at the time of this writing. This project is estimated to cost \$572,000.

### Effects and Issues

This project will reduce land loss in this area by blocking saltwater intrusion and lowering water levels in the Lakes Sub-basin thereby preserving valuable habitat for the benefit of wetland dependent fish and wildlife populations. Fisheries access will likely be improved in the area by opening the Oak Grove Canal by opening it to the GIWW.

### Status

This project is conceptual and requires feasibility and design. It may be a candidate for future priority lists.

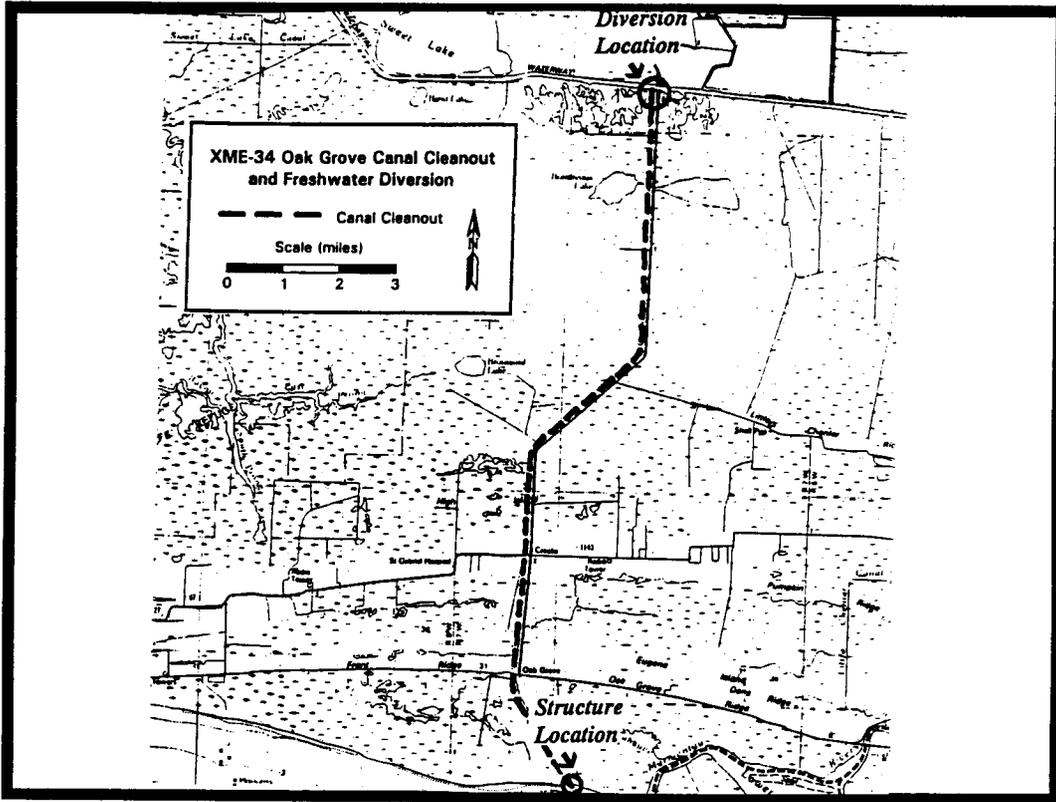


Figure 47. (XME-34) Oak Grove Canal Cleanout/Freshwater Diversion.

## SUPPORTING LONG TERM PROJECTS

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### XME-39 UPPER MUD LAKE LEVEE REPAIR

#### Location

This project is located the Chenier Sub-basin along 2.5 miles of Upper Mud Lake shoreline in Cameron Parish, Louisiana (Figures 5 and 48). The acreage of this project area has not been determined.

#### Problems and Opportunities

Wave activity on Upper Mud Lake has eroded away at the protection levee around the lake allowing saltwater from the Mermentau River to intrude on adjacent intermediate wetlands. An opportunity exist to refurbish the levee using material dredged from the lake. This project is compatible with the basin strategy of maintaining the geologic framework of the interior basin by controlling erosion of shorelines and navigation channels.

#### Description of Features

This project calls for restoration of levee along 2.5 miles of Upper Mud Lake shoreline.

#### Benefits and Costs

Rapid protocol Wetland Value Assessment data is unavailable for this project making benefited acreage information nonexistent at the time of this writing. This project is estimated to cost \$750,000.

#### Effects and Issues

The project will provide protection to the marshes surrounding Upper Mud Lake from saltwater intrusion and wave erosion thereby preserving valuable fresh and intermediate marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

#### Status

This project is conceptual and requires feasibility study and design. It may be a candidate for future priority lists.

## XME-41 GRAND CHENIER PROTECTION LEVEE

### Location

This project is located in the Chenier Sub-basin three miles east of Upper Mud Lake north of Grand Chenier Ridge in Cameron Parish, Louisiana (Figures 5 and 48). The acreage of this project area has not been determined.

### Problems and Opportunities

The Grand Chenier protection levee serves the dual purpose of protecting fresh marsh north of the chenier from saltwater intrusion via the Mermentau River and flood protection for the chenier ridge. This levee is slowly deteriorating and may, in the long-term, need to be restored in order to protect the fresh marsh landward of the chenier from saltwater intrusion. This project is neither compatible nor incompatible with any of the basin strategies.

### Description of Features

This project calls for restoration of 20,000 linear feet of levee north of Little Chenier Ridge between LA 27 and the Mermentau River.

### Benefits and Costs

Rapid protocol Wetland Value Assessment data is unavailable for this project making benefited acreage information nonexistent at the time of this writing. This project is estimated to cost \$900,000.

### Effects and Issues

The project will provide flood protection for the Grand Chenier Ridge and prevent saltwater intrusion into the fresh marshes north of the ridge thereby preserving valuable fresh and intermediate marsh habitat for the benefit of wetland dependent fish and wildlife populations. No adverse impacts are expected from this project.

### Status

This project is conceptual and requires feasibility study and design. It may be a candidate for future priority lists.

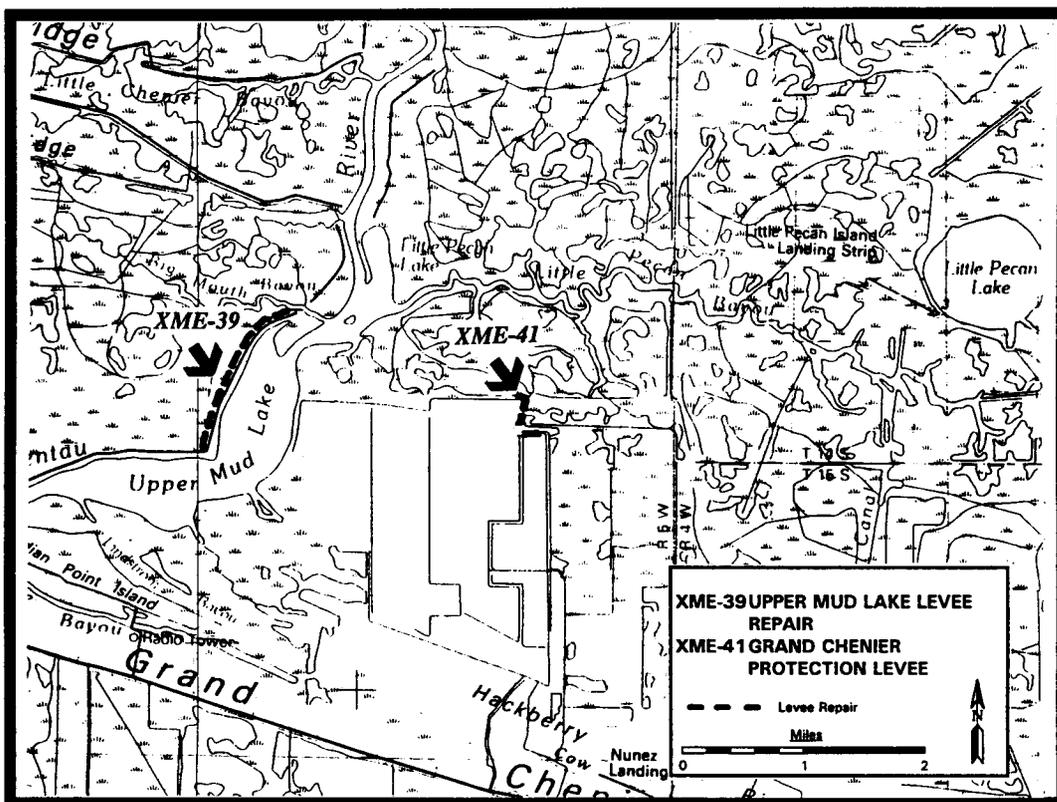


Figure 48. (XME-39) Upper Mud Lake Levee Repair and (XME-41) Grand Chenier Protection Levee.

## SUPPORTING RESEARCH

### WATER MANAGEMENT

Research is needed to explore the feasibility of removing floodwaters from the Grand and White Lakes system via the Gulf Intracoastal Waterway. Sustained high water levels have accelerated shoreline erosion rates and stressed emergent marsh in the Lakes Subbasin. Studies are needed to determine whether bypass structures constructed near Calcasieu Lock and Leland Bowman Lock could increase drainage without impacting navigation.

### SHORELINE EROSION

The objective in over half of the projects in the selected alternative is the control of shoreline erosion. Presently, limestone rip-rap and various wave stilling devices combined with vegetative plantings are used to control this problem. Vegetative plantings are successful in low wave-energy situations and rip-rap is effective under high wave-energy conditions. However, rip-rap is expensive, can pose a navigation hazard, and can be difficult to install in shallow water areas. Research is needed to develop a cost-effective alternative to the use of rip-rap for shoreline protection in high energy areas.



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**Legend**

- 1 AB Floating
- 2 AB Submerged
- 3 Fresh Water
- 4 Estuarine Water
- 5 Fresh Marsh
- 6 Intermediate Marsh
- 7 Brackish Marsh
- 8 Saline Marsh
- 9 Estuarine Marsh
- 10 Cypress Forest
- 11 Bottomland Forest
- 12 Dead Forest
- 13 Bottomland SS
- 14 Shore/Flat
- 15 Ag/Pasture
- 16 Upland Barren
- 17 Upland Forest
- 18 Developed
- 19 Upland SS

Louisiana Coastal Wetlands  
 Restoration Plan  
 Mermentau Basin  
 1988 HABITAT DATA

date: April 1993